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Under the sponsorship of the National Project in Agricultural Communications, a series of 14 lessons by various authors has been compiled to serve as a reader or training manual in the field of visual communications. Several models of communications are outlined and evaluated. Many studies which concern themselves with the concepts of source, encoding or decoding methods, channel, message, and receiver are described briefly. The development, structure, and function of visual perception are sketched, with reference made to the part that individual differences, motivation, and set play in visual communication. Several specific theories of perception are presented in a condensed form. Some guidelines for planning and evaluating a communications program are laid down. The choice and use of effective design and appropriate medium for visual communication are discussed. Some solutions to problems in obtaining, coordinating, storing, and filing visual materials are offered. Research studies on the roles of drive, cue, response, reward, and visual factors as a part of the learning process of communication are surveyed. An extensive bibliography is included. (JY)

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Research, Principles, and Practices in

Visual Communication

Department of Audiovisual Instruction • National Education Association

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This book was originally published as a part of the Communication Training Program developed by the National Project in Agricultural Communications for the American Association of Land-Grant Colleges and State Universities.

The present edition is a reprint of the original work and has been published by the Department of Audiovisual Instruction as a contribution to scholarship in the field of visual communication.

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Research, Principles, and Practices in

Visual Communication.

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Foreword

This foreword attempts to answer the two questions most likely to be raised about this book; What is it? How did it come about?

Since 1954, the National Project in Agricultural Communications has been engaged in developing and conducting training programs in communication. Primary audiences for these programs have been the state and field staffs of the Agricultural Extension Services, but many other groups and agencies have enrolled in and benefited by the programs.

Earlier NPAC training programs in communication concentrated on the basic elements of the communication process, and on the specific areas of oral and written communication. These programs and their effects stimulated demands for a similar unit in visual communication.

Recognizing that the ultimate audience for any new program in visual communication would be essentially the same as that already exposed to the basic, oral, and written units, NPAC saw in this development opportunity to reinforce the previous instruction while at the same time providing a solid base for training in visual communication.

Since suitable reference material in the field of visual communication was extremely limited, NPAC decided to sponsor the writing, editing and printing of this basic reader in communication, with special emphasis on the visual aspects. This decision was sparked in part by the advice and contributions of some 50 persons who participated in the planning and development of the training unit in visual communication.

Late in 1958, NPAC mailed a preliminary outline for a training program in visual communication to more than 50 educators, communication theorists, visual specialists, training directors, and agricultural editors. Along with the outline, NPAC commented as follows:

> "To make a significant contribution, this unit must grow out of and relate to the relevant and established theory and research on how people communicate and learn. In what ways, for instance, do what kinds of visual approaches facilitate the learning, retention, and application of knowledge, concepts, and skills?
>
> "Is it possible to inter-relate in a meaningful way research and theory pertinent to perception, learning, communication, and visual presentation?
>
> "How, when, and why do what kinds of visual presentation enhance the attention-value, understandability, or acceptability of specific communications?
>
> "In the answers to such questions must lie the basic structure or fundamental theme for a training unit in visual communication."

Throughout 1959, a series of conferences produced the plan for the training program, the outline for this book, and a team of competent, dedicated people responsible for preparing lesson plans and/or chapters for the book. The book and the training program were launched simultaneously in January, 1960, at the first of several two-week training sessions.

The publisher (NPAC) and the editors regard the book as a preliminary edition, and plan an expanded edition within the year. The expanded edition will be extended by several chapters, and further integration will eliminate duplication.

Paragraphs are numbered throughout to facilitate use as a reference manual for trainers and teachers. Little of the content of the training program will be found in the training guide; content is referenced in the guide by use of the paragraph numbers in the book.

The style of bibliographic reference generally follows that of the author of the chapter. All references have been consolidated in the comprehensive bibliography at the end, listing all items mentioned in the book. A more extensive bibliography is contemplated in later editions. In indexing the book, the paragraph numbers are used instead of pages.

As a whole, the book is a working reference manual. Editorial decisions have been based on criteria which emphasized convenience and usefulness. The editors hope that the book will open to the reader the whole range of research pertinent to visual communication, and that the bibliography will direct readers to interesting and fruitful areas of knowledge.

Acknowledgments

Although it seems an almost impossible task to list and thank all the persons and institutions who have contributed substantially to the production of this book and the related training program, the NPAC publicly expresses appreciation as follows:

1. To the Agricultural Extension Services and related elements of the various Land-Grant institutions whose support, cooperation, and confidence made possible the various communication training programs.

2. To the more than 50 persons who gave generously of time, ideas, and materials to facilitate development of the visual communication training program.

3. To the many individuals and publishers who permitted reproduction and adaptation of previously published materials for use in this book and related training program.

4. To members of the Division of Audio-Visual Instruction, National Education Association, for assistance in finding consultative talent, materials, and resources.

5. To staff members and various departments, colleges, and services of Michigan State University for a wide range of facilities and services necessary to the planning, development, and illustration of the book and training program.

6. To W. K. Kellogg Foundation whose financial support since 1953 has made possible the general operations of the National Project in Agricultural Communications.

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1. Process: The Conceptual Basis for Communication Study

prepared by John Ball

1.1 The Concept of Process

1.11 Before the concept of process, men thought of the world as a place where things happened more or less independently of each other most of the time. The relationships between events were often interpreted as magical rather than natural and organic. Science in its early development studied static rather than dynamic relationships, and fixed answers were sought to solve fixed problems.

With the concept of process, we are able to think about and grasp the implications of events that are going on, events that are complex structure of events which in turn are complex structures of events. Thus we are able to approach human events, such as communication situations, and to study them without oversimplification, with awareness of the operating variables, and with proper awareness of the limitations of our study. It is the concept of process that prevents our supplying easy formulas for communication and that permits us instead to promise an approach that is realistic and based firmly on current knowledge in a range of scientific fields.

1.12 Communication itself is a process, a complex of events operating in several dimensions of space and time, and always involving the attitudes, the knowledge, the communication skills of more than one person and the social and cultural context in which he is located. To consider communication, then, it is necessary to focus the mind on more than one event—perhaps dozens of events—taking place simultaneously or consecutively or partly simultaneously and partly consecutively, events which take place at different rates of development and with different importance and different effect.

The process of communication requires the same extended and diverse kind of awareness that is required for driving a car on a busy street, amid stimuli from all directions. This enlarged focus of mind is required for considering not only each communication situation, but also each aspect of communication situations. Yet this enlarged focus does not reduce communication to a hopeless jungle of tangled events but rather makes clear both the reasons for communication failures and the bases of communication success.

1.2 A Case Study of Process

1.21 To begin, we shall consider a process involving only one person: a man unloading his camera.

1.22 The man has a goal, a PURPOSE. We also know that he must have a VALUE for this kind of activity, to make him consider it worthwhile to expend energy in this way. He is surrounded by his ENVIRONMENT. All of these may change during the process: the goal may change to include an evaluation of how it is possible to get film out of a camera without jamming the mechanism; the value may be sidetracked by a higher priority, such as a phone call sending the man out on an emergency errand; the environment may get hotter or colder or lighter or darker, and if the man is unloading his camera on a train, he may enter a tunnel and be forced to stop the process.

1.23 The man keeps feeding his PRESENT OBSERVATION into the process: stimuli of sight, sound, and feeling particularly are operative in permitting him to continue the process successfully. Also, he keeps feeding in his PAST EXPERIENCE with cameras, particularly this camera, and with the kinds of events that require manipulation of small mechanical objects by the fingers. Also, each event in the process becomes part of the man's IMMEDIATE PAST EXPERIENCE, and influences the developing process. If the man lacks past experience, he can develop a body of immediate past experience by trial and error, and proceed on immediate past experience

and present observation alone. We should note that the man observes things other than the camera, and things about the camera irrelevant to his purpose; that he remembers things that are also irrelevant, and may in fact be thinking about another kind of subject entirely while he is unloading the camera; and that only part of the immediate past experience is relevant to the developing process.

1.24 The camera itself brings in its shape or FORM a functional design which helps to shape the process; in a sense it represents the crystallized experience of past processes. The form is both limiting and freeing. Although it is unlikely that the man will try to change the camera itself, and thus must stay within its functional capacities, the fact that the designer has already done so much of his work for him frees the man to use his energy to make creative adaptations.

1.25 Now let us introduce a variable: a human being seven years old who has been in the environment all along, but far enough away not to be noticed. This small boy has just broken his toy airplane, and as he tells what happened, with great excitement, the man continues to unload his camera. We now have a cluster of processes. The unloading-camera process continues while the boy concludes a successful process-of-securing-attention-and-repair-for airplane and the man begins the communication process of calming-and-soothing-the-boy and the thought states of the process fixing-the-plane. Several new purposes have developed, and a new value priority has been established. The camera is laid aside, and the already-planned repair job is begun.

1.26 With the addition of this second person, another concept is added to the factors shaping the process: the idea of IMAGE. When the man was unloading the camera he did not have to be concerned with the attitude of the camera toward him; he did not have to project images of the EXPECTATIONS of the camera, and evaluate his actions in terms of those expectations. But while cameras do not have expectations, small boys do have: and the way the man talks and acts is perhaps even more important to the boy than the fact that the airplane eventually gets fixed. Thus the man reacts not only to the stimuli he receives from the boy, but to a complex image of expectation that he has formed as a result of many past events, an image of expectation which serves as both a pattern and a standard of behavior.

1.3 A Case Study of Communication

1.31 Finally, let us consider the whole process of unloading the camera as a communication process, in a different situation. Now we see that our man sells cameras in his store, and is engaged in showing a customer the way the camera is loaded and unloaded. The purposes of the salesman and his customer are different: the salesman wishes to create a favorable attitude toward the camera as a device that is easy to operate, and to teach the customer so clearly that the customer will not be disappointed in the results he later obtains. The customer wishes to find how to use his new camera, but he is less interested in means than in ends, and what he wants as quickly as possible is pictures. Thus he may give inadequate attention to a portion of the demonstration that is not clearly connected with taking pictures. In the demonstration situation neither person has the purpose that ordinarily will be dominant when a camera is being unloaded: the purpose of getting the film out so that it can be processed.

1.32 Besides having different purposes, the salesman and his customer have different values (and these values are interrelated with the purposes), different images of expectation of each other, two different sets of past experiences to feed into the process of unloading the camera, and two different interpretations of the immediate past experience relevant to the developing process. They share the same environment and receive many of the same stimuli, but their interpretations of their present observation also differ.

1.33 Perhaps the salesman will as a result of long practice use highly developed habits of muscular coordination in manipulating the camera; while these habits are an aid in getting the camera unloaded, they may be a barrier to communication if the salesman takes parts of the process so much for granted that he fails to recognize a need to demonstrate them.

1.34 The communication process we are describing, in which a salesman is communicating with a customer, uses many CODES. Gesture is a code; the salesman uses gesture when he points his finger at a part of the camera to which he wishes to call attention. Perhaps the salesman will use graphic art as a code if he shows the customer a diagram in a book of instructions. But the chief codes that will be used are demonstration and language. Demonstration provides the customer with present observation of the process in action; language provides him with a set

of symbols which he can interpret only through his past language experience.

1.35 He may find MEANING for the salesman's symbols; and if the salesman is good at his job the customer may find meanings near the meanings the salesman had in mind for him to find. However, no two people ever share exactly the same meaning for a symbol—and communication breakdowns often occur because the person encoding the message (we call him the SOURCE) assumes that the meaning he has is in the word that he uses, so that the word will freeze the meaning into the message where any receiver who can read will take it out intact.

1.36 Actually there are many different kinds of meaning; the salesman may tell the customer that he is moving the camera's rewind lever too jerkily and have the customer respond not to the DENOTATIVE meaning "Unless you operate the lever more slowly you may damage the mechanism" but to a CONNOTATIVE meaning derived from his past experience and associations: "You certainly seem to be a very nervous person." Or the customer may get a different meaning from tone of voice than he gets from words; "You are very quick to learn the use of the camera" may be interpreted, because of intonation, to mean "I don't see why it takes you so long to catch on to something so simple."

1.37 The salesman and his customer belong to or are a part of several different SOCIAL SYSTEMS, and are holding their conversation within a social system which establishes certain ROLE behaviors for salesmen and for customers. The communication between them is affected by their differing STATUS. Role and status are important in shaping the image of expectation each has of the other, and the image of expectation each has of himself and his own behavior in his role. Also, the communication process will be affected by the CULTURAL CONTEXT from which and in which the salesman and his customer operate—and to the extent that context differs for the two, a kind of cross-cultural communication becomes necessary.

1.38 Between any two factors in the total communication process, or among several or all of them, there may be influence and counter-influence, either negative or positive or both. Because of the way past and future influences can be traced it cannot be said that a communication process begins, or ends, at a certain point. Even a message which seems to produce no consequence ("nothing happens") will probably influence later events ("I'll try a different kind of message" or "I'll approach some other readers or listeners.")

1.39 The concept of process is one of the most significant ideas of our time: perhaps, indeed, the most significant. Its implications reach into every aspect of human life and thought; it is the basis both of modern science and modern philosophy. It is the DYNAMICS in thermodynamics; it is relativity, and the interrelatedness of multiple events, and the concept of space-time, and the nature of life. Yet it goes back to the first ancient philosopher who said you can never step in the same stream twice, and it clearly has just as much relevance to communication as it does to Einstein. However sharply we narrow our focus of attention in considering visual communication, it is important that we hold to awareness of the total process and approach specifics as part of larger processes.

2. The Interaction Model: Perception and Communication

prepared by George Gerbner

2.1 Introduction

2.11 As students of communication we are in an ambiguous professional position. It is easier to note differences of background, training, and specialized interests and activities among us than to decide what field of inquiry or body of knowledge brings us together. Often we hang a shapeless Mother Hubbard called "communication" over that body—whatever it is—and, after the proper offerings to some tribal deities called "verbal" or "non-verbal", "audio" and/or "visual" (depending on the season), we drift from one specific topic, gadget, technique, or bit of information to another, with occasional rituals in honor of the Great Spirits "science" and "research." At other times we act more as professionals (or even competent technicians) should. But even when we locate a common field of inquiry and find at least parts of a body of knowledge we can call communication, we still have difficulty deciding whether we are drinking from the fountainhead of all the humanities, arts, and sciences, or navigating turbulent cross-currents of established disciplines, looking for a chart and a charter.

2.12 No single occasion or group is going to settle that problem. But no group of professionals planning to take a close look at the theory, practice, and teaching of visual (or any other) communication can avoid developing some views and plan of activities bearing directly on that problem. Students, practitioners, researchers, teachers, administrators coming together for the discussion of special interests in communication have an opportunity to pose the question: how do our immediate concerns fit into the broadest possible view of communication as a field of study?

2.13 I would like to take advantage of that opportunity, to advance some suggestions concerning (1) communication as a professional, scientific, or scholarly discipline, (2) the analysis of communication as a process, (3) a conceptual model of communication, (4) some standards of judgment in communication, and (5) a plan of practical activities grouped around key issues. I trust that these remarks will not be taken either as final pronouncements as as pure provocations to argument. My hope is that a discussion of broader perspectives and implications will make the achievement of specialized objectives more meaningful and memorable.

2.2 Communication as a Field

2.21 Preoccupation with the nature, quality, and functions of communication is probably as old as mankind. Indeed, we can view this concern as part of the evolutionary process which transformed some anthropoid creature into Homo Sapiens, and which makes members of that species into "our kind" of human beings.

2.22 Yet the study of communication by that name as a scientific and professional field is a newcomer in our vocabulary of disciplines. We cannot be sure yet whether it is only a new name standing for a variety of ill-fitting activities in the arts, sciences, and professions, or a genuinely new approach to certain types of human problems. My hunch is that if communication survives the well-intentioned efforts of its adherents it might develop into a respectable discipline.

2.23 The magic of a new term, invoked to support budget, to defend practices, to build academic or professional empires, fades quickly. Fashionable slogans elevated to the stature of theory but supported by unexamined rationalizations fall into disrepute. An approach to human problems can exist without magic and rationalizations but not without a *rationale*. A rationalization is concocted to justify the existence of some practice. A rationale cannot be concocted at all. It *is* the reason for the existence of the practice. It is either rooted in developments that demand reorganization of studies and approaches, or the field has no good reason to exist at all.

2.24 I think the reasons for the existence of communication as a new field can be found in the trends and developments of the last century. Some of these are philosophical and scientific, others are educational, technological, social, and political.

2.25 The philosophical and scientific developments arose partially in revolt against Aristotelian logic and Newtonian mechanics, and partially out of apparent despair of making much sense out of shifting reality existing outside of the senses themselves. These trends ushered in what is sometimes called "the age of analysis" in philosophy, psychology, and the natural sciences. The primary object of analysis became the human subject himself; the study of his experience, both conscious and unconscious, became the "positive" basis for "objective" knowledge. But since appearances proved to be so subjective, the meaning of objectivity itself became confused with sole reliance on the pooling of subjective impressions. Whatever the weaknesses of these trends in social and scientific philosophy—and this is certainly not the place for a critique—they helped focus attention on the nature and varieties of appearances (phenomena), the process of interpreting experiences (observation, perception, learning), and the interpersonal and social context in which appearances and experiences were symbolized, transmitted, and shared.

2.26 These focal points of attention involved key aspects of communication. More and more philosophers, psychologists, physicists, and other scientists began to use the term and to claim that their approach could best be described as a "communication" approach.

2.3 Communication Revolution

2.31 This trend in scientific philosophy was not essentially new, and by itself it probably would never have provided impetus for the development of communication as a discipline. Such an impetus came, however, from that world of objective events whose real nature, the "positivists" claim, we can only communicate about more-or-less successfully but never definitely assess. The "Communication Revolution" of our time, it seems to others, consists of a series of concrete historical developments whose nature and relevance to human experience we can and must assess.

2.32 Communication products became mass-produced. The increasing tempo of technological-social-cultural developments in communication, beginning with rapid printing and gaining momentum with film, radio, and television, became the cultural characteristic of our age. The new media of communication impressed us with their ability to transmit messages and images across previous barriers of space, time, and individual ability or status. The media created new networks of influence, new audiences, new markets, and new institutional empires. They also gave us new means and forms through which to observe each other and the world, and new points of view from which to survey the inner and outer environment.

2.33 The term "propaganda" took on new meanings. We found that centralized means of communication could be used to blot out diversity from the synthetic images of life presented. On further reflection and study, "propaganda" was found to draw most of its strength from the everyday context of popular culture—consisting mostly of mass-produced communication products—rather than from single campaigns or messages.

2.34 Bigness, monopoly, costliness in cultural (as in other) industry brought centralization of control, standardization of product, streamlined efficiency of techniques, and increasing penetration of influence into many spheres of life. These developments brought new delights into lives that seem drab in retrospect; they also raised new concerns about the meaning of freedom in contemporary culture.

2.35 Large and intricate systems of all kinds demanded new ways of handling the mass of information needed for decision-making. Theories and methods of data processing, information transmission, storage and retrieval of communication records had to be developed.

2.36 The study of communication processes and effects became a necessary part of policy-making in business, industry, and government. The implications of new media and methods of communication for human learning were vigorously debated, then soberly appraised. Studies and experience led to a general concern with the overall quality and context of communication in teaching. The "communication approach" spilled over into learning theory, the study and teaching of spoken and written language, and into such ancient disciplines as rhetoric, esthetics, logic. Investigation of the broader educational implications of the communication revolution was initiated, and study of cultural consequences has begun.

2.4 Criteria for a Framework

2.41 Can such diverse developments provide the rationale for a coherent area of studies? Certainly a general concern about a variety of vaguely related processes and practices is not a sufficient basis for the existence of a discipline, even if it suffices for the establishment of university departments, research institutes, journals, national projects, and workshops. Such general concern is not sufficient because it does not provide a definition of tasks, an integrated approach to definite areas of problems, a conceptual framework for study and action.

2.42 It is equally obvious that any definitions, approaches and frameworks in communications should be hospitable to diverse interests, areas of specialization, and scientific points of view. They should accommodate the study of structure as well as of function; they should permit the analysis of inner and interpersonal processes as well as of social and institutional systems and relationships; they should allow for the existence of subjective appearances as well as of objective events; they should be suggestive of standards of judgment as well as of analytical distinctions. Finally, they should structure communication as a field and a process into manageable aspects, dimensions, and relationships.

2.43 Needless to say, no such paragon of a model of communication exists. Our next task, therefore, is to build one. (Or, more seriously, to suggest a way of conceptualizing and discussing communication that satisfies some of these requirements, and gives us something to point to when in doubt as to what we are talking about.)

2.5 The Interaction Model: The Statement

2.51 I would like to suggest a way of translating our generalized concerns about communication into a theoretical framework which can generate definitions, structure discussion, and lead to judgments. This will involve considerations relevant to the analysis of process, to the characteristics of communication as a process, to the diagrammatic representation of events, relationships, and dimensions involved, to the construction of a "model," and to standards and activities that might flow from these.

2.52 Communication[1] is communicat*ing*. It is a pattern of doings, a process. This means that it is a flow of events so interrelated that one act in the series derives part of its significance from all other acts, and can be fully grasped only in the light of the total pattern. Can we analyze such a fluid, dynamic, interrelated pattern of events? We can, if we remember that in reality it *is* fluid, dynamic, and interrelated and that categories of analysis are frozen images abstracted for purposes of discussion and understanding. The historian Allen Nevins once defined an event as "a force made momentarily visible." Let us use this concept to examine the pattern from different angles so that different aspects and relationships become "momentarily visible"; then let us capture this "vision" to see what it reveals of the forces behind it.

2.53 What *kind* of a process is communication? Any definition is bound to be arbitrary, so let us at least be practical. The existence of anything can be said to "communicate" its own existence, so we cannot use the term in such a broad sense without blurring the special significance it should have for a workable definition. We should find some ingredient, some special event embedded in this process we are to call communication that sets it apart from other processes. That special ingredient is the *message* or *statement*.

2.54 I look out the window and see a tree; that is not communication (at least by the definition I am proposing). But when I look at a picture of that tree or hear someone say "there is a tree outside the window" that is communication simply because the process included a message or statement as an essential ingredient. We need not be too concerned with hairline distinctions and borderline cases except perhaps as a form of intellectual exercise. But for those who take such exercise seriously, let me offer a more technical definition: *A message or statement is a specialized, formally coded or symbolic or representative social event which makes possible inferences about states, relationships, processes not directly observed.*[2]

---

[1]The singular, communication, connotes the unitary concept of process. Communications tends to emphasize the pluralistic concept of a diversified field, or the multiple ingredients of the process with emphasis on media, channels, messages, etc. Generally, the singular form is used throughout this book.

[2]For a more detailed statement see G. Gerbner, "On Content Analysis and Critical Research in Mass Communication," *Audio-Visual Communication Review*, 6:85-198, Spring 1958.

2.55 The message is what distinguishes communication from other processes, but its existence alone is not sufficient for communication. Let us consider the words on this paper. They are a message or statement. Its code is the English language in one of its printed forms; its content is (as we shall argue later) the relationship of this form to the act of communicating. Yet these words on paper do not add up to communication. They are only one event in a pattern which involves my thinking and writing and your reading and thinking, among other things.

2.56 I just referred to two distinguishable dimensions in the process. My principal relationship to the statement is that of producer; your principal relationship to the statement is that of reader. Let us visualize what we have so far by drawing circles for events (broadly interpreted), lines for relationships, and using the vertical and horizontal for our two dimensions.
Thus we have

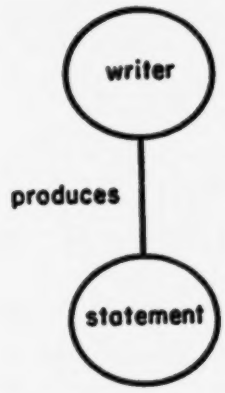

Fig. 2.1.

along the vertical dimension, and

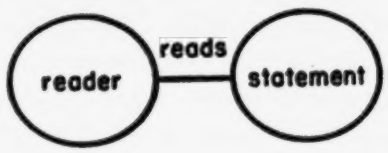

Fig. 2.2.

along the horizontal dimension. Although the piece of paper on which I write and the paper and type you read are not identical, the "statement" links what I do and what you do into a pattern we call communication. The processes and consequences of this pattern are different from those of other relationships between people. Most of the differences rest in the nature of the message.

2.57 Messages have *form* (which may be a code, symbol, or representation) as do all other objects and events; but they have a *content* unlike that of most other events. This content (which, of course, is an attribute of a specialized form as used in a certain context and situation) can only be defined in relation to other things not in the message but inferrable from the message. These "other things" include the way the message was produced (the vertical dimension of the diagram). Sometimes we can infer some things about the source of the message (the circle at the top of the vertical dimension). But usually we also want to make inferences about other events and subjects; we want to know what the message is "about."

2.58 For example, if what I write here is "really" only a reflection of my personality, mood and skill (or lack of skill) but has no demonstrable relevance to the communication process as it exists independently of my wishes, then for all practical purposes it is a useless statement (unless you happen to be interested in my personality, skill or wishes, all of which are irrelevant to our present purposes). If this statement is "really" only about me and my use of words, you could only evaluate its expressiveness, its grammar, its pleasing sensory qualities, its efficiency in conveying my thoughts. You could *not* assess its adequacy or accuracy in the light of independently existing observations and criteria about the process I am trying to describe. If you asked "Why is this so" and I answered "Because I think so" you would have no recourse. A more objective appraisal would be possible only if we specified at the outset that the nature of what we are talking about, outside of thoughts and wishes, is germane to the pattern of communication.

2.59 While this might seem an obvious contention, it marks an important distinction in one's approach to the study of communication. It is at this point that the "positivistic" conceptions and models of communication, useful as they are for specialized analytical purposes, fail to meet our criteria for a framework in which to study communication. These models (unlike, for example, the Westley-MacLean model[3]) lack reference to an event, subject matter, etc., to a segment of reality outside the communicating agents themselves, to the event the communication is "about."

2.6 The Interaction Model: The Event

2.61 If we omit from our scheme that element of the process which is purportedly encoded, symbolized, represented, or "talked about" — no matter how remote it may seem at times — we have limited the range of uses and consequences we can attribute to communication or to its study. Specifically, we have excluded any

[3]See discussion of Westley-MacLean model, 3.5.32.

analysis of statements or of the process in terms other than form, design, structure, subjective associations and the like. We have no way of relating the message, its production, and its uses, to anything existing outside of the mind, the nervous system, the machine, or the institution that comprises the communicating agent or agency. Thus we have no way of explaining, evaluating, or even understanding the message and its functions in the light of independently existing events and points of view; we cannot ask questions about its truth or validity; and we cannot inquire into consequences other than its success in achieving aims and gratifying desires of the communicating parties.

2.62 We shall come back later to the significance of being able to establish such relationships and ask such questions. Now let us apply the argument of the preceding discourse to our diagram of the communication process. We tried to establish the point that as your attention is directed to the words you are reading, and in them to the events and concepts these words are "about," my attention in writing these words is directed to the events I am trying to describe. That is, the producer of a statement "reads" (i.e. inquires into) events as the receiver of the statement reads the message. So we have two somewhat similar relationships along the horizontal dimension joined in a pattern through the common element, the statement (see Fig. 2.3).

Fig. 2.3.

2.7 The Interaction Model: Perception

2.71 This does not mean that you, the reader, cannot inquire directly into the nature of the events I am describing (although most of our communication involves things *not* directly observed or observable by most parties in the process). What it does mean is that as you read my statement you observe *my way of inquiring into and describing* the event. Nor does my statement get directly transferred to your mind; you are observing *in your own particular way* my way of seeing and describing things. I perceive an event in my own way and produce a statement about it; you preceive my statement about the event in your own way—and react accordingly. Thus we need one more element in our diagram (Fig. 2.4) that stands for the particular way in which communicating agents inquire into, perceive, interpret events and statements. Let a smaller circle inside communicating agents stand for events and statements "as perceived."

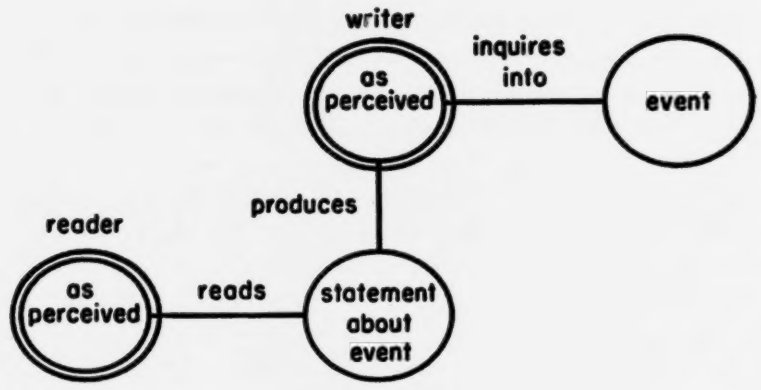

Fig. 2.4.

2.8 The Interaction Model: Aspects of the Process

2.81 We can, of course, extend the diagram indefinitely.[4] We can put in any number of communication sources and receivers, indicate multiple statements, or events, etc. But the basic elements and relationships remain the same. So instead of complicating things at this point, let us reduce our diagram to the minimum necessary to a communication act, and give each part a generalized name. Then let us indicate a few other important aspects that play a part in the process but are not easily visualized.

2.82 We have identified two basic relationships in our scheme. The horizontal line stands for our relationship with the world of events and statements. No single term can do justice to the complexity of this relationship; it involves ways of observation, conception, inquiry; it implies selection in a certain context. Let us call it the *perceptual dimension.*

2.83 The vertical line represents another type of response to our environment: a reaction that produces a change in the state of

[4]Such extensions and a variety of applications can be found in G. Gerbner, "Toward a General Model of Communication," *Audio-Visual Communication Review*, 4:171-199, Summer 1956.

affairs outside of ourselves.[5] If the product of this change is a communication event (message, statement), we have the ingredient which distinguishes communication from other processes. Communication events are created when someone uses some means (channels, media, facilities) in some controlled (i.e., non-random) fashion to produce a signal. Let us then call this vertical production "response" the *means and controls dimension.*

2.84 We also have three kinds of "events" represented by circles in our diagram: non-communication events, communication events and communication agents or agencies. Let us define each of these in general terms.

2.85 **Non-communication events** germane to a communication act can be perceived by communication sources or produced by communication receivers. Let these be single circles marked E in our generalized program. Thus an event perceived would be:

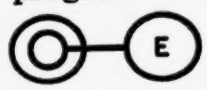

Fig. 2.5.

And an event produced would be:

Fig. 2.6.

2.86 **Communication events** are messages or statements about events. Let us represent them by divided circles marked SE for "statement about event." In Fig. 2.7, we have diagrammed (a) a message perceived, and (b) message produced:

Fig. 2.7

2.87 **Communication agents or agencies** are represented by two concentric circles. These stand for sources, receivers, and their terms of perception. Let us mark communicating agents M for man or machine (although they can also represent institutions), and indicate the terms of perception by attaching a prime (′) sign to whatever is perceived or attended to as the object of the communication. Thus we can diagram a communication act in which someone perceives an event and makes a statement about it which is perceived by someone else (Fig. 2.8):

[5]Sometimes perception can be achieved only at the cost of changing the event being observed.

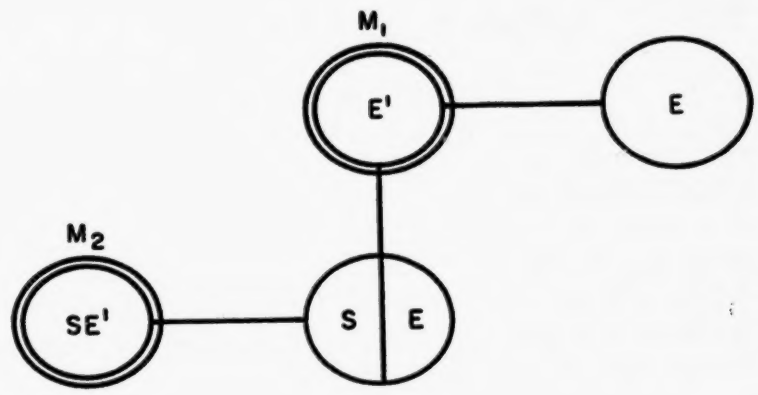

Fig. 2.8

2.88 Four other aspects remain to be noted. Each of these has an important bearing upon the process and study of communication: (a) The *situation* in which events and messages are produced and are perceived; (b) the perceptual *context* in space and time in which messages are produced and perceived; (c) administrative, legal, political, etc., arrangements controlling the *availability* of messages; and (d) the *consequences* of communication acts aside from immediate reactions or from desired effects.

2.89 Awkward as it is, the following verbal "model" of communication has the virtue of noting in a single sentence ten basic elements of the process identified in our discussion:

SOMEONE/PERCEIVES AN EVENT (OR
1 2

STATEMENT)/AND REACTS/IN A SITUA-
3 4

TION/AND THROUGH SOME MEANS/TO
5

MAKE AVAILABLE MATERIALS/IN SOME
6 7

FORM/AND CONTEXT/CONVEYING CON-
8 9

TENT/WITH SOME CONSEQUENCE.
10

In the following sections we shall review and describe each of these elements in a more systematic fashion.

2.9 Steps in the Process

2.91 We shall use a dramatized diagram (Fig. 2.9) of a communication act to retrace the ten steps of our verbal model. Then we shall review each of the elements in the process, and cite examples of questions that direct attention to each as a major variable for study. We shall also develop a truncated form of the basic diagram to indicate the place of most characteristics of the communication process within its scope.

2.92 Assume that someone notices a house burning across the street and shouts "Fire!" to someone else. This act of communication is illustrated below with each aspect of the process indicated on the diagram.[6]

2.93 Step 1 of our model is illustrated on the diagram as a human head representing *someone.* This is the M of the generalized diagram, here a communication source. Next comes the *event and its perception.* The event, here a burning house, is shown as circle E. Its perception is indicated as Step 2, a line leading horizontally from circle E, the event, to a circle inside M; the inside circle is labeled E' — event E as perceived by M. In Step 3 of our model, M *reacts* to having perceived the event. (If this reaction involves use of some means to produce a message, it will be represented under Step 5.)

2.94 Step 4 makes note of the fact that all perceptions and reactions occur in a *situation.* M is shown observing E from behind a window, indicating one feature of the situation. It is usually impractical to schematize a situation on a generalized model. Step 5 marks the communicative nature of the reaction. It designates the *means,* the mediating channels and controls transmitting a signal (here "voice"), as a line leading downward from the communicating agent, M, to the comunication product, SE.

2.95 The means serve to make available materials to X designations. Availability for perception is shown as Step 6, a line leading horizontally from the communication product to another person, M_x. Use of some means becomes a signal only if it is not random; that is, if it is *in some form.* Step 7 indicates the formal characteristics of the use of the means. It is represented as a half-circle attached to means, labeled S for signal or statement. (Here *form* might be denoted as a certain language sequence.) Every signal exists in a *context* of other signals and statements. The three circles of Step 8 along the horizontal, perceptual, dimension denote context. Again, it is often impractical to schematize context except by considering it an ever-present feature of the perceptual aspect.

2.96 The *content* qualities inherent in M's use of means in S form are marked E to denote those qualities of SE, the communication product, which reflect, represent, symbolize, or refer to the event. Thus the total communication product, SE, means signal or statement S, about event E, in this case: "Fire!" The *consequences* of this communication event can be appraised only in terms of all other aspects plus time; Step 10, therefore, cannot be adequately visualized.

[6]This illustration is drawn from the earlier article "Toward a General Model of Communication," *op. cit.*

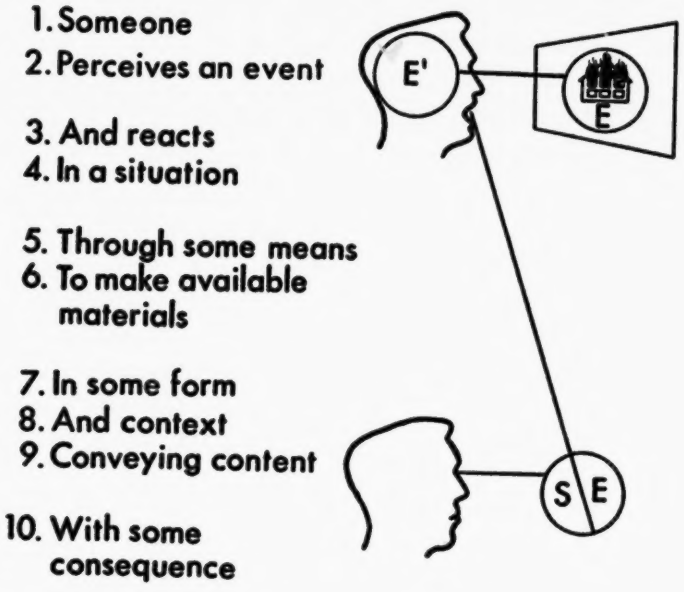

Fig. 2.9. A dramatized version of the Interaction Model.

2.10 Analysis of the Model

2.10.1 Now we are ready to characterize each aspect more fully, and to crystallize the basic diagram.

1. **"Someone"** — the communicating agent (source or receiver) may be a person, organization, etc., in any communication transaction. The M of our diagram stands for the general physical and social characteristics of the parties involved in the communication process — senders or destination of messages, communicators and their audiences. When we say "She looked so sincere that they believed her story," or "He is too young to understand that picture" we are pointing to this variable as an important element in the process. When we discuss the structure, history, or method of operation of a communication industry or enterprise, or the nature of its audiences, we are dealing with M.

2.10.2 2. ". . . **Perceives an event (or statement)**" — the perceptual — cognitive (horizontal) dimension of our diagram involves the relationship between events (and statements) and the way these might be recognized, perceived, approached. Perception is selective; we must select from what is available, and do so in a certain context of other things also available for perception. Thus, selection, context, availability are important variables for study. So are the psycho-physical characteristics of the perceptual process, and its social and experiential aspects. Perceptual as well as conceptual approach, point of view, predispositions, and need-value systems are among the significant aspects of this process. In its most general sense, this dimension represents man's orientation to his environment, as well as the nature and structure of the environment available for orientation and selected for attention or inquiry.

2.10.3 3. ". . . **And reacts.**" Overt reaction to the perception of an event or statement has been assigned to the vertical dimension of our diagram. If this reaction leads to the production of a message, we have SE at the bottom end of the "means and controls" dimension; if it is some other kind of reaction, we can represent its outcome by a non-communication event, E.

2.10.4 When we are dealing with the communicative reaction of a communication source, we have, of course, the production of a statement. But when we examine the reaction of a communication receiver, we are dealing with communication *effects*. We usually measure these against the aims of the communicators, or satisfactions of the receivers. (When measured by other criteria, we shall call them "consequences.")

2.10.5 4. ". . . **In a situation**"—All perception and reaction takes place in a situation. Certain aspects of the situation are often overlooked in the analysis or planning of communication. Some of these elements are physical: room size, location, light, heat, sound, condition of equipment, etc. Others are social: group size, composition, the structure of human relationships involved. Still others are procedural: method of utilization and presentation of communication materials, sequence of activities, etc.

2.10.6 5. ". . . **Through some means,**" —the means and controls (vertical) dimension of our diagram. Here we deal with choice of channels and media, and with techniques (as well as institutional arrangements) of producing (or mass-producing) messages. New media and new techniques stimulate much discussion and research about relative values. There is no evidence to support claims for the general superiority of any one medium, channel, or mode of perception over all others. But there is evidence to indicate that the choice of means has implications for the meanings of messages, as well as for their perceptual qualities, distribution, and availability.

2.10.7 6. ". . . To make available **materials.**" Availability is one outcome of the use of means and controls to produce messages. We have assigned it to the perceptual dimension to emphasize that the technical, legal, administrative, political, etc., functions in communication need to be viewed in the light of what they make available for selection. While the "means and controls" dimension calls attention to production and distribution systems, the "availability" aspect emphasizes administrative and other arrangements determining freedom of access to materials.

2.10.8 7. ". . . **In some form.**" The form of the communication event is represented on the diagram by the S (for signal or statement) portion of SE, the message. Analysis of form may be structural, logical or psychological. Structural and logical analysis of form have to do with such internal relationships as design, style, organization, syntax, sequence, code, statistical properties, etc. Psychological analysis has to do with such external relationships as conventional usage, connotations, associations, feelings or attitudes evoked in users.

2.10.9 8. ". . . **And context.**" Context is another aspect of the perceptual dimension. It is the composition of the perceptual field in which a particular event or statement is selected for perception. In other words, it is what comes before and after the message, or what surrounds the message in a particular communication situation. The study of context focuses attention not on the general physical and social aspects of the communication situation, nor on the general sequence of activities followed in a presentation, but specifically on the effect of other messages upon the perception of the message selected.

2.10.10 9. ". . . **Conveying content.**" If we take SE as standing for "statement about event E," then we can interpret the E aspect of message SE as those external relationships of the statement which have reference to what the message is "about" (i.e. subject matter) or to other events and functions inferrable from messages taken as objective records of specific communication acts.

2.10.11 This latter view of content is an unusual one, especially for those accustomed to looking at messages only in terms of the struc-

tural, logical and psychological aspects of form. I am not suggesting any mysterious "potential" or "latent" characteristics outside of message forms. I am suggesting that there is another important way of looking at messages besides the analysis of forms and of subjective associations. Whether we intend it or not, or are aware of it or not, a specific message is not only a vehicle for signs and symbols but also an objective social event. It is not only a report but also a *record.* As such, its content includes the imprint of circumstances and points of view which may be unintended and unrecognized but which are nevertheless functional qualities of the communication transaction. Messages viewed as objective social events may be a source of inference revealing (at least to the analyst) some things about the process that produced them and about a range of consequences quite apart from what sources and receivers intend or "mean" by them.

2.10.12 We may analyze a photograph not only to study subjective responses to the conventional forms reported in it but also to determine possible consequences of the objective "points of view" recorded in it (e.g. by means of camera angle or ways of lighting), whether or not the subjects responding to the photograph are aware of these "points of view." We may study a series of whiskey ads not to appraise their design qualities, measure their effects on sales or on ideas about whiskey, but to make inferences about some more subtle social relationships recorded and reflected in them (such as frequency with which their image of the "good life" involves the services of Negro waiters or Filipino houseboys). We might want to study an exhibit not only to analyze the quality of graphics and the arrangement of objects but to find out how adequately it reflects current knowledge about a subject, and how honestly it expresses the state, purposes, and functions of the organization arranging it. Or we might analyze magazine policies or television programming to see how it reflects — regardless of intentions, likes or dislikes — the state of the industry and the approach of the business to the world of events it communicates about.

2.10.13 Content as a record of objective relationships is not primarily a matter of skill, talent, craftsmanship or showmanship. It is primarily a matter of where we actually stand in relation to the events, subjects, ideas we communicate about, and what we actually do in specific communication transactions. The questions we ask about content as we defined it are primarily questions of truth and validity. These questions will lead us to the consideration of a theory of *judgment* in communication.

2.10.14 10. **". . . With some consequences."** The intention of the previous category was to broaden the scope of inquiry about communication content. The intention here is to call attention to an area of "effects" outside the scope of those desired, anticipated, or recognized at any one time. The need for this category arises in part from our view of content as an objective social event. Once such an event is brought into being it makes some contribution to certain irreversible processes. The full "meaning" of this contribution rests in the actual consequences inherent in the sum total of changes brought about.

2.10.15 Frequently we are only interested in finding out how changes in behavior, ideas, attitudes, etc., consequent to the perception of message relate to purposes of communicators, objectives stated in messages, or to needs and desires of receivers. We have classified this type of effect analysis under study of "reaction." Study of the full range of consequences in communication includes the consideration of often unintended or unrecognized effects. We should ask not only "Was I successful?" but also "What else has changed, or is likely to change?" as the result of the communication. There are no communication "failures" except in terms of specific objectives. Every communication act has consequences; these are never limited to specific objectives; and the parties involved in a communication transaction are often unaware of the full range of significant consequences.

2.10.16 If we analyze a communication "failure" in this light, we might find that we have "succeeded" in communicating an actual relationship to our subject which conflicted with our stated purpose. Some wartime films which, in order to emphasize the danger, unwittingly glorified the Nazis had such "boomerang" effects. The same can be true of communication "successes." Some can deliver a 4th of July speech about democracy in such an authoritarian manner that when the eloquent words are forgotten only a relationship of threat and fear remains. There are teachers who feel that their communication was effective if students pass a rigid examination yet develop a dislike of the subject or even of learning. Absorbing an avalanche of information may narcotize rather than energize people.

2.10.17 Here we are concerned not only with effectiveness but also with the total price to be paid for certain effects. Long range effects are often different from short range; behavior is sometimes in conflict with ideology, or not rationalized at all; unapparent effects may have

serious consequences; desired effects, such as making people do the "right things" by tendentious propaganda, may impoverish the bases of self-direction—a consequence too costly in the long run.

2.11 Summary Diagram

2.11.1 Our summary diagram of communication appears in Fig. 2.10. It includes all but those elements of the process which could not be assigned to any one aspect or dimension.

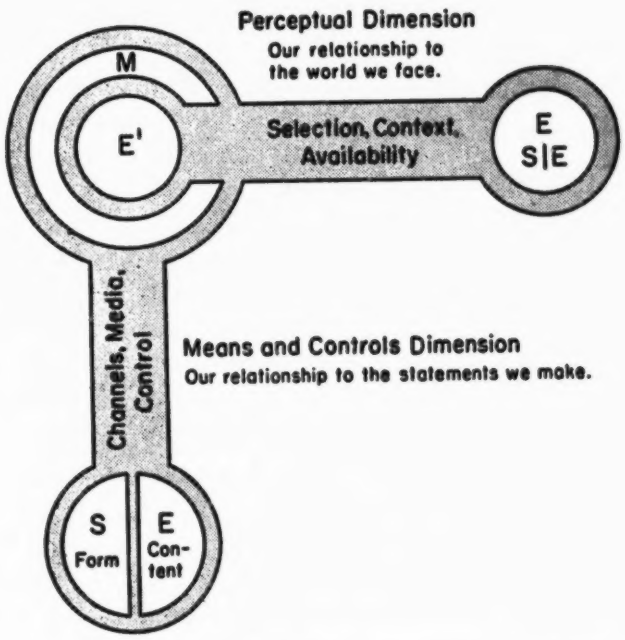

Fig. 2.10. Summary diagram of communication.

2.12 Judgment

2.12.1 The construction of a framework for the study of communication involved critical choices. We have contended, among other things, that the acts of abstraction, recognition, and representation carry within them — often unwittingly — the seeds of judgment. If I only look up from my chair and gazing upon an object remark "I see a chair," I have done more than simple "sensing." I have abstracted certain characteristics of the object, recognized and named them, recorded a relationship and a vantage point, and thus assigned to that object an approximate role, function, and value in the context of our culture.

2.12.2 Our task would be incomplete without an effort to germinate the seeds of judgment inherent in the much more complex task of building a conceptual framework for the study of communication. In this necessarily brief form, the effort is likely to appear more conclusive and dogmatic than it means to be. But such are the occupational hazards of a special obligation of professionals (including professors) to *profess* — i.e., (according to Webster's) "to avow publicly." I think those risks are worth taking if they help us examine our notions of the relevance of what we do to the priorities of value we hold.

2.13 Freedom, Responsibility

2.13.1 We begin with the basic assumption that communication is a "humanizing" process. "Humanizing" *Homo sapiens* involves changing reality in the light of changing conceptions of the requirements of survival and welfare.

2.13.2 We can derive certain standards from these premises if we can establish the ideal "humanizing" qualities of communication in social life. And we can arrive at some judgments by applying these standards to communication functions, institutions, and practices.

2.13.3 The perceptual dimension of our model represents the process of inquiry, the selection and perception of events and statements in some context of availability. The ideal state of affairs of this dimension of communication is, I think, *freedom.* What we usually ask for along this dimension is the *availability of a diversity of events, statements, and points of view, so that we might select freely in a representative context of pertinent evidence.*

2.13.4 But the quality of freedom along the perceptual dimension is neither an absolute quality nor an end in itself. It is physically, socially, and psychologically *structured* and *determined.* Its purpose is not merely to provide exercise in choosing, but primarily to provide the setting most favorable for the making of *correct* choices. Let us then consider how the structure of freedom is determined and what the "rightness" of choices might mean.

2.13.5 The purpose of freedom in communication is to assure public availability of statements and points of view pertinent to decision-making and self-government. The popular definition of this freedom as "the right to say what I please" can lead to its negation if I have access to a loudspeaker but others don't. Freedom to *talk* might abolish the freedom to be *heard.* That is why we have assigned freedom to the horizontal dimension of inquiry and perception, and not to the vertical dimension of the use of means, channels, facilities for the production of statements.

2.13.6 The structure of freedom is organized diversity whether it pleases or not. It is

determined through the systematic use of means, channels, media, and other facilities for the production (and mass-production) of statements. If these means and facilities are to produce a structure of freedom, they must be organized and used *to that end.* Freedom of use of facilities (the vertical "production" dimension of our diagram) on behalf of any other end, private or public, serves other ends. If the ideal structure of inquiry and perception along the horizontal dimension is to be *freedom,* the essential quality along the vertical production dimension has to be *control.* Control of means and facilities to promote diversity of availability and freedom of selection is a major administrative and governmental responsibility in communications.

The determination of the structure of freedom in industrial culture as an administrative and governmental function is illustrated in Fig. 2.11 as the social relationship between the production and the perceptual dimensions of our communication model .

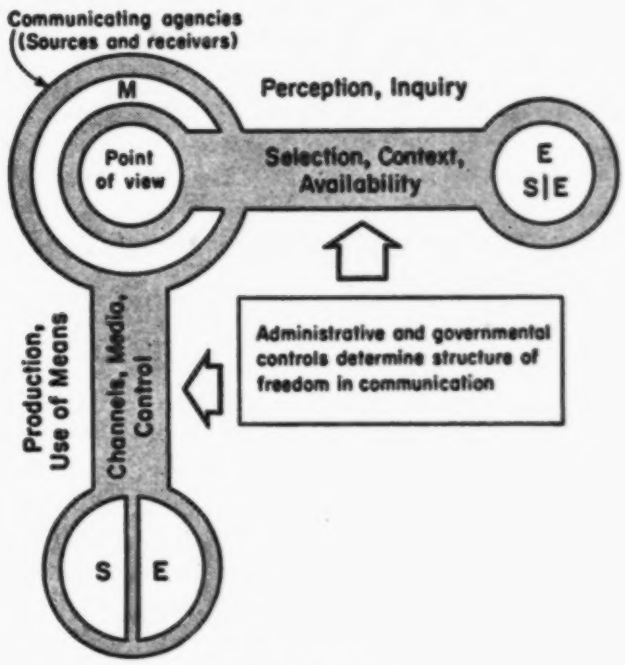

Fig. 2.11.

The social responsibility to promote freedom in communications through the organization of means and facilities to that end does not imply that the structure of freedom is an absolute quality, or that it is diversity for its own sake. Freedom of public communication in any society can be considered an index of the extent to which the state of affairs in communication permits public insight to penetrate relevant realities of existence. It is an index of the complexity and diversity of a communications structure organized to enhance opportunities for learning, judgment, and decision-making serving the "humanizing" ends of survival and welfare.

Let me advance a proposition: Communication can help human insight to deal with realities of existence to the extent that its products are true, valid, and believable. Now let us develop the meanings and implications of this proposition.

2.14 Truth

2.14.1 *Truth* in communication is a *quality of content.* It is not a "thing" that exists independently of statements. The truth of statement is a measure of qualities of correspondence, adequacy and coherence of its relationship to the event the statement is "about" — a relationship asserted or recorded in what we defined as its content. To judge the truth or falsity of a statement (or the proposition for which it stands) we need to examine its *correspondence* to the event (in the conventional forms of a culture), its *adequacy* in emphasis, intensity, etc., and its *coherence* with other statements about the event known to be true or false. The truth quality of a single specific proposition is dichotomous. Such a proposition can only be true or false, in the sense that the proposition 2 plus 2 equals 5 cannot be considered partially true or almost true, but only false. The truth quality of complex statement or of a body of statements can be expressed in terms of the qualities of single specific propositions contained in them. Truth quality is provisional only in the sense that we might be unable to assess it or might assess it erroneously at any one time. Otherwise it can only be an absolute quality because both events and making statements about events are unique and irreversible occasions whose relationships to one another — with all their qualities — are likewise unique and irreversible.[7]

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[7]It might be well to deal here briefly with some misconceptions which often arise at this point and lead to such questions as: "Is this an argument for 'absolutism'?" and "Who is to determine this 'truth quality'?". I think this position is the only ideological defense *against* 'absolutism'. For if truth is itself a subjective judgment rather than an objective quality of statements to be appraised more or less successfully, then absolute power over such judgments—i.e., "thought control" could actually remake reality rather than only our consciousness of reality. Thus it is the relativistic position that becomes an argument for "absolutism" as a viable social order. Our conception of the truth quality of statements as an objective (and only in that sense "absolute") relationship to changing realities of existence makes the structure of freedom a necessary condition for its assessment. Assessment by whom? By anyone who satisfies accepted criteria for the verification of statements.

2.14.2 We can illustrate this conception or truth as an objective relationship between statements and events on our diagram (Fig. 2.12):

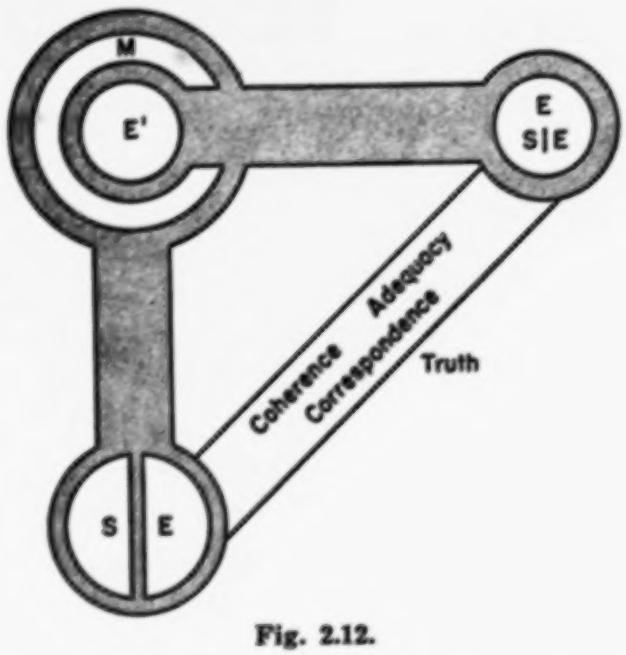

Fig. 2.12.

2.14.3 The content of statements, as we defined it, records not only a relationship but also a vantage point from which events are viewed. The judgment of that aspect of content is concerned with *validity*. The question of validity focuses attention not on the fidelity or accuracy of a statement but on the value attributes imparted through the particular approach or "point of view" apparent in the message. One can photograph the same face in ways that make equally "true" likenesses appear "good" or "evil" (e.g., by making a light cast shadows down or up); one can make two equally factual accounts of murder give the impression of either crime or heroism; one can omit reference to events or claim no factual basis (as in purely persuasive or fictional statements) and still imply an approach to events. Judgment in such cases centers on the question of validity.

2.14.4 The development of standards for the assessment of validity, as of truth, is a social process. The appraisal of the validity of approaches and the truth quality of statements in the light of current standards of reason and evidence is the activity we call *science*. The "humanizing" function of science in communications is the formulation of true statements and valid approaches to inquiry.

2.14.5 Who communicates the human relevance of scientific beliefs to the layman? Who transforms true and valid perceptions of the human condition into imaginative representations, in forms most people can understand, believe, and even enjoy? That, I think, is the social communication function of *art*. The "humanizing" role of art in communications is to sensitize us to the perception of relationships and points of view whose appraisal science makes possible.

2.14.6 The summary diagram (Fig. 2.13) illustrates ideal qualities and functions in social communications.

2.14.7 Along the horizontal dimension we see the ideal process as *valid perceptions freely selected in a representative context of pertinent evidence*. Adding "beliefs" as a controlling factor in human actions, we find the ideal quality along the vertical dimension as *clear expression of beliefs through effective means and forms*. Combining these with the hypothenuse of our triangle representing truth, we formulate the ideal qualities in communication as *true beliefs reflecting valid points of view freely selected in a representative context of pertinent evidence and clearly presented through effective means and forms*. Condensed into a briefer proposition: *true beliefs freely acquired and believably presented*.

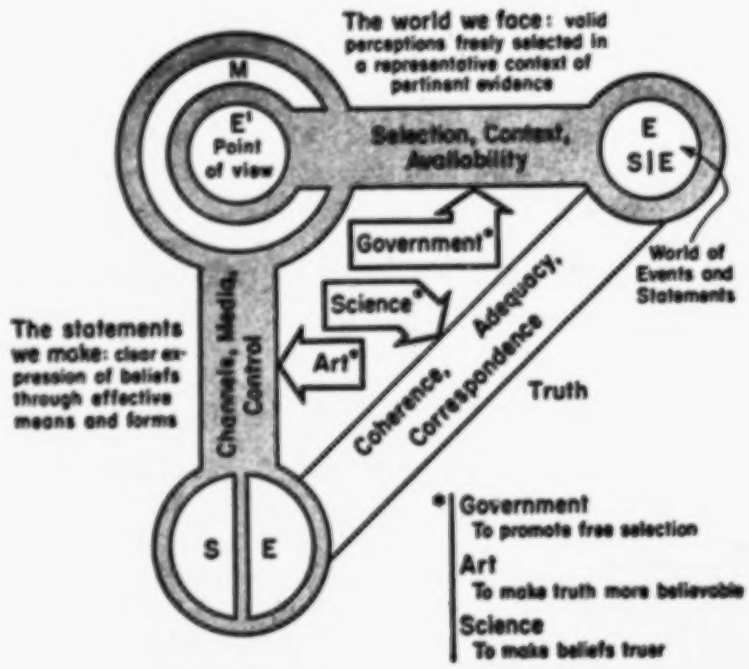

Fig. 2.13.

3. Communication Models

prepared by Erwin P. Bettinghaus

3.1 Ways of Looking at the Communication Process

3.11 The Interaction Model discussed in Chapter 2 represents a carefully prepared and fully developed approach to communication; in many ways it is the most useful approach yet outlined. However, it is but one of many ways of looking at the process of communication. Psychologists, sociologists, businessmen, physicists, agricultural specialists, and journalists represent only a few of the professional groups whose members have developed ways of looking at and talking about the communication process in their specialized fields. As the student of communication reads about communication, he soon finds himself surrounded with a somewhat confusing variety of definitions, charts and mathematical symbols — all purporting to explain or to represent the communication process.

3.12 In many cases, the charts, diagrams and symbology are called "models" of the communication process. Yet, many of these models bear little surface resemblance to one another. Before looking at some of the communication models, it seems reasonable to explore the values in a study of models of the communication process.

3.2 Kinds of Models

3.21 Different groups of scientists use the word "model" itself in different ways. Sometimes they substitute it for terms like "theory," "analogy," 'flow chart," "hypothesis," and "explanation." In some cases, the term has been regarded almost as if it were *magic* and as if the mere labeling of a particular visual as a model automatically clears up all possible misunderstandings about a process.

3.22 The "model," as a code, supposedly represents the real process. Thus it is *not* substitutable for the process itself. A model, if perfect, would show all possible aspects of some process, i.e., it would represent the process occurring in the real world with perfect fidelity. Or to put it in another way, a perfect model would be isomorphic, i.e., the parts of the model would correspond in an exact one-to-one relationship to the process as it exists in the real world.

3.23 Naturally, the limitations of the graphic arts, and the automatic imposition of stasis that visualization carries, means that dynamic, ongoing processes cannot be reproduced with perfect fidelity. Thus models range from high to low fidelity in the degree with which they represent processes. The criterion for selection of a particular model in any given case is not based primarily on the fidelity or correspondence to reality of the particular model, but rather on the model's *usefulness.*

3.24 The criterion of utility in selection of a model becomes more understandable when we consider the types of models available. At one level, models are merely *descriptive.* A descriptive model might be used to identify the elements of a particular process, or to indicate areas from which questions may be drawn for future research. Most of the models of the communication process mentioned here are purely descriptive.

3.25 At a different level, we can talk about an *operational* model. An operational model attempts to describe the process in such a way that measurement operations and predictions are possible. Information theory provides a model which can be called operational in the sense in which we have used it here. At still a different level, we can attempt to develop a *functional* model. A functional model is not necessarily descriptive, but attempts to specify certain relationships between elements of the process so that other and new relationships are generated. There are few functional models in communication as we know it today, or for that matter, there are few such models in the behavioral sciences.

3.26 With this background, the criterion of utility becomes clear. If the desire of an individual is merely to identify the elements of a process which are meaningful to a particular task, a descriptive model is all that is necessary. Furthermore, the task to be accomplished also determines the level of fidelity which may be necessary. If the process is difficult to understand, a low fidelity model may induce more understanding with fewer repetitions than a high fidelity model which is far more complicated.

3.2. The next section looks primarily at the relative usefulness of certain communication models in accomplishing two tasks: determining the types of questions which might be answered or raised from a particular model, and accomplishing the job of achieving listener or reader understanding about the process of communication.

3.3 Communication Models

3.31 Communication models come in a variety of forms — written, expressed mathematically, or as a non-verbal visualization. They may be oriented to different problems. They may be designed to explain transmission of information over mechanical systems, explain the social nature of human communication, express the neurological function of the brain, or predict message form and structure.

3.32 Communication models can be placed along several kinds of dimensions. In each case, the dimension chosen is one which fits a particular situation under study. Thus a model might be constructed to emphasize the psychological aspects of communication. Other common models seem to be derived for the purpose of explaining communication in small groups, the relationship between the newspaper and the mass audience, communication in the polarized speaker-audience situation, or for diagramming the process nature of communication.

3.33 Regardless of the particular emphasis shown, at least two things are clear. Models are constructed for particular purposes, i.e., to serve a criterion of utility. Second, communication models never include all possible elements of the communication process as it exists in the real world. Models are selective, and elements are picked for particular models which seem to occur within the process of communication in ways which fit the particular situation being examined.

3.4 Two Non-Visual Models

3.41 Perhaps the best known verbal model of communication is also the oldest. Aristotle, writing in his *Rhetorica* 300 years before the beginning of the Christian Centuries, provided an explanation of oral communication which is still worthy of attention. He called the study of communication "rhetoric" and spoke of three elements within the process:

> Rhetoric falls into three divisions, determined by the three classes of listeners to speeches. For of the three elements in speech-making — speaker, subject, and person addressed — it is the last one, the hearer, that determines the speech's end and object.[1]

From an analysis of the three elements of speaker, speech and audience, Aristotle details characteristics which each element might have. His is an audience-centered exposition which attempts to place the emphasis in communication on persuasion:

> . . . Since rhetoric exists to affect the giving of decisions . . . the orator must not only try to make the argument of his speech demonstrative and worthy of belief; he must also make his own character look right and put his hearers, who are to decide, into the right frame of mind.[2]

3.42 If we ask ourselves what the differences are between the model proposed by Aristotle and ones constructed in the present century, only one major difference seems apparent. Aristotle did not talk about a *channel* for communication as do most modern accounts. Yet the *Rhetorica* rather carefully examines many of the factors which make for effective oral or written communication. In its emphasis on the listener, Aristotle originates a philosophy of communication carried out in the two models discussed later, SMCR and Interpreter.

3.43 Aristotle's traditional view provides the core of Harold Lasswell's much quoted formulation of the main elements of communication: "*Who* says *what* in which *channel* to *whom* with what *effect*?"[3] Lasswell's question is a model of communication, a model which points to the significant elements of the process as Lasswell saw those elements. Although this model has stimulated research in communication — particularly research involving mass media — the model is of limited use in teaching the process of communication. It tends to focus on pure description

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[1, 2]Aristotle, *Rhetorica*. Translated by W. Rhys Roberts, in *Basic Works of Aristotle*, Richard McKeon (ed.), New York: Random House. 1941.

[3]Harold D. Lasswell, "The Structure and Function of Communication in Society." In Lyman Bryson (ed.), *The Communication of Ideas*. Institute for Religious and Social Studies, 1948, p. 37.

of the elements of the process and fails to identify relationships between elements. It fails to indicate the importance of situational variables. And it is oriented in a "one-way" fashion, i.e., it ignores the notion of process.

3.44 Words are static. Purely verbal models of the communication process, of which Aristotle and Lasswell provide only two examples of a group from which many others could be chosen, have two great disadvantages. They are frequently lengthy, and if not lengthy, of limited usefulness. They are seldom able to indicate the dynamism of a communication situation.

3.5 Some Visualizations

3.51 This section discusses briefly a number of communication models which have been visualized in several ways. A complete discussion of any one model is beyond the scope of the chapter. Yet it may help one to gain a background in communication to see some of the various ways people have expressed visually their communication interest. The section following discusses two models in much greater detail with the emphasis on use of the models in teaching.

3.52 In 1949, Claude Shannon, of the Bell Telephone Laboratories, and Warren Weaver, then with the Rockefeller Foundation, made scholarly hearts beat considerably faster with the publication of their book *The Mathematical Theory of Communication.* They attempted to do two things: reduce the communication process to a set of mathematical formulas, and discuss problems which can be handled with the model. They intended their formulation to apply to all communication, including mechanical communications systems. Fig. 3.1 below shows the Shannon and Weaver visualization. Because Shannon's definitions of the elements of the process as he saw them are rather precise, we repeat the entire definition here.

3.53 By a communication system we will mean a system of the type indicated schematically in Fig. 3.1. It consists of essentially five parts:

3.54 1. An *information source* which produces a message or sequence of messages to be communicated to the receiving terminal. The message may be of various types: (a) A sequence of letters as in a telegraph or teletype system; (b) A single function of time f(t) as in radio or telephony; (c) A function of time and other variables as in black and white television — here the message may be thought of as a function f(x, y, t) of two space coordinates and time, the light intensity at point (x, y) and time t on a pickup tube plate; (d) Two or more functions of time, say f(t), g(t), h(t) — this is the case in "three dimensional" sound transmission or if the system is intended to service several individual channels in multiplex; (e) Several functions of several variables — in color television the message consists of three functions f(x, y, t), g(x, y, t), h(x, y, t) defined in a three-dimensional continuum — we may also think of these three functions as components of a vector field defined in the region — similarly, several black and white television sources would produce "messages" consisting of a number of functions of three variables; (f) Various combinations also occur, for example, in television with an associated audio channel.

3.55 2. A *transmitter* which operates on the message in some way to produce a signal suitable for transmission over the channel. In

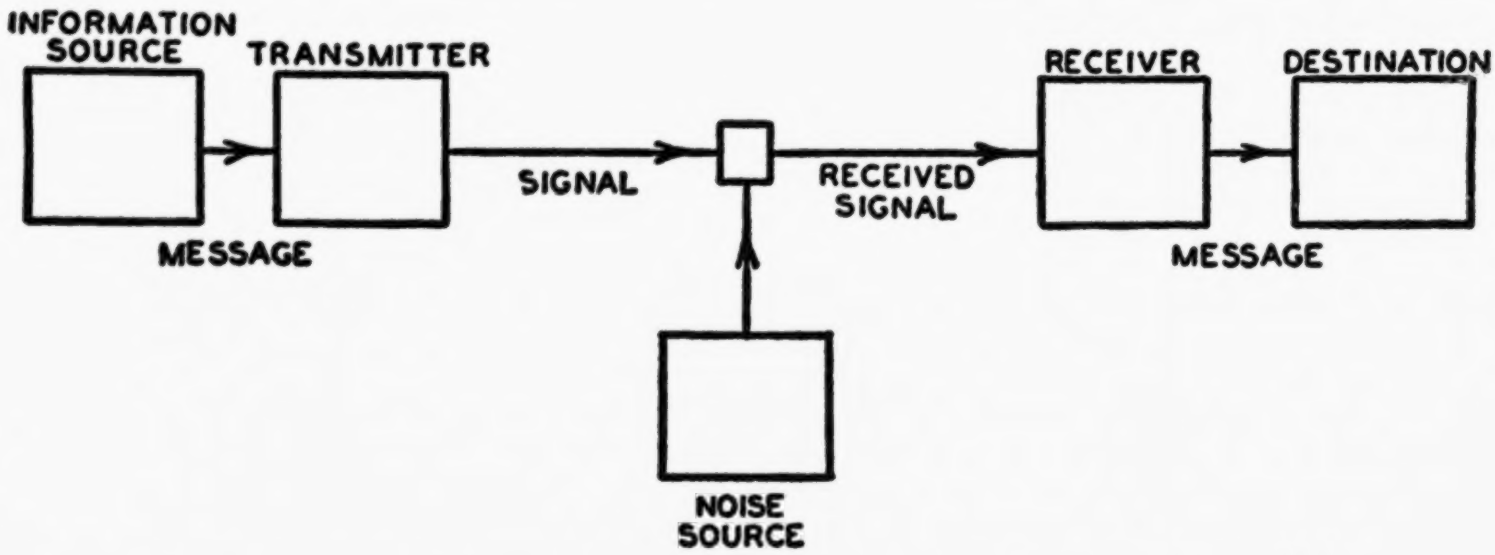


Fig. 3.1. Schematic diagram of a general communication system: Shannon and Weaver Model.

telephony this operation consists merely of changing sound pressure into a proportional electrical current. In telegraphy we have an encoding operation which produces a sequence of dots, dashes and spaces on the channel corresponding to the message. In a multiplex PCM system the different speech functions must be sampled, compressed, quantized and encoded, and finally interleaved properly to construct the signal. Vocoder systems, television and frequency modulation are other examples of complex operations applied to the message to obtain the signal.

3.56 3. The *channel* is merely the medium used to transmit the signal from transmitter to receiver. It may be a pair of wires, a coaxial cable, a band of radio frequencies, a beam of light, etc. During transmission, or at one of the terminals, the signal may be perturbed by noise. This is indicated schematically in Fig. 3.1 by the noise source acting on the transmitted signal to produce the received signal.

3.57 4. The *receiver* ordinarily performs the inverse operation of that done by the transmitter, reconstructing the message from the signal.

3.58 5. The *destination* is the person (or thing) for whom the message is intended.[4]

[4]Reproduced with permission from pp. 4-6, *The Mathematical Theory of Communication*, Claude E. Shannon, and Warren Weaver. Urbana: The University of Illinois Press, 1949.

3.59 Shannon and Weaver were not interested in the psychological aspects of communication, and thus not really concerned with problems involving common communication breakdowns. Thus questions of the order: "What role does the attitude of the receiver play in communication?" are not immediately derivable from their model. Neither were they particularly interested in the dynamic aspects of human communication considered apart from other possible communication systems. Thus, if the purpose in studying communication is an attempt to isolate the causes of communication breakdowns in certain kinds of human communication, the Shannon and Weaver model will give only rather general help. From the Shannon and Weaver book, however, has come a wealth of research material and other theoretical formulations.

3.5.10 To see how the Shannon and Weaver model can be adapted for other and more specific purposes, see Jerome Rothstein's book *Communication, Organization and Science*. Rothstein argues that there is an analogy between communication and measurement amounting to an "identity in logical structure." His visualization, reproduced in Fig. 3.2, adds relatively little to the Shannon and Weaver model, yet shows the relationship he is interested in describing rather precisely. He describes his visualization rather concisely:

"The blocks and upper captions follow Shannon's characterization of a communication system; the lower captions give analogous terms for a measuring apparatus. The system of interest cor-

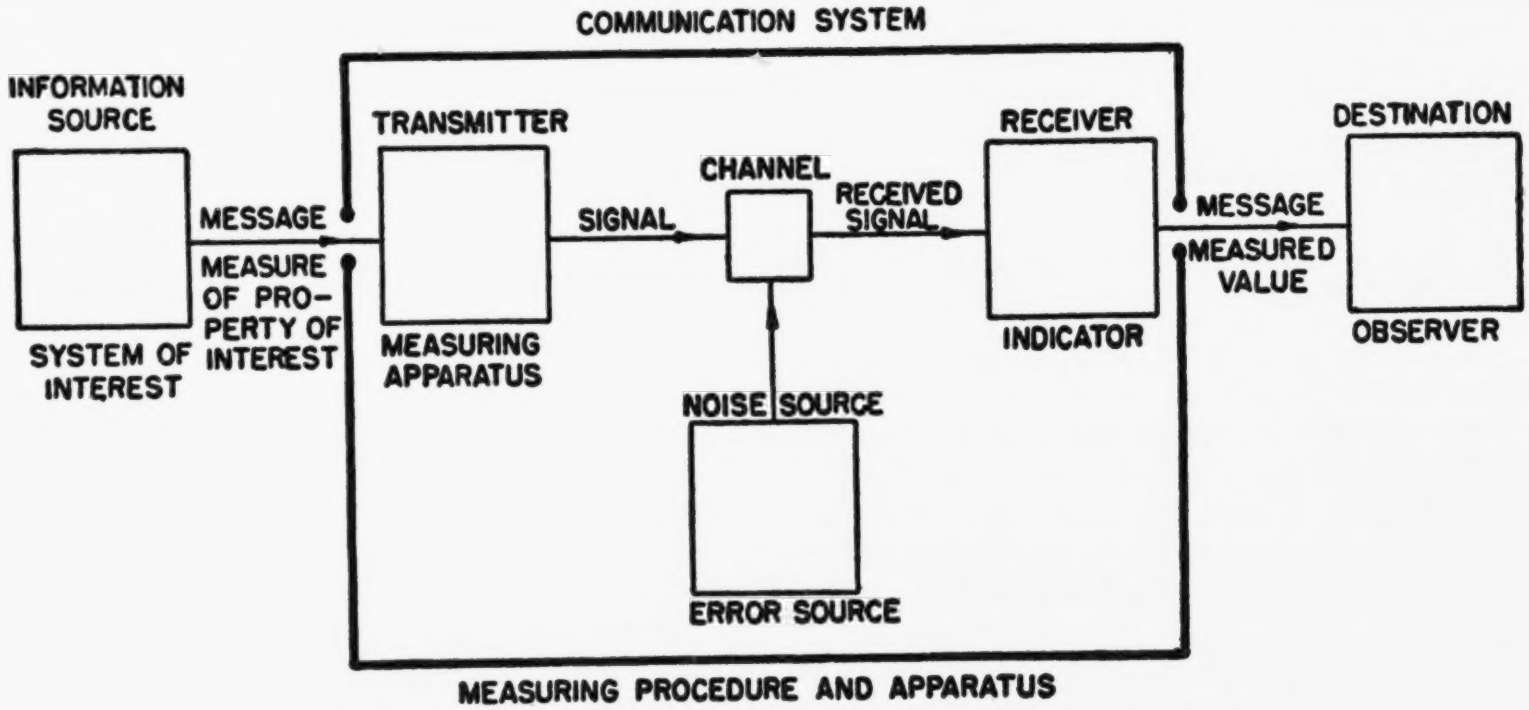


Fig. 3.2. The analogy between measurement and communication: Rothstein Model.

responds to the information source; the observer, to the destination for which the message is intended. The message corresponds to a measure of the property of interest, which is often encoded by the transmitter or measuring apparatus into information-bearing variations of some physical quantity often quite different from the one of direct interest. This signal, corrupted by noise or errors, is decoded by the receiver or indicator and presented as a message or measured value at the output of the system."[5]

3.5.11 Rothstein is not attempting to describe all of the communication, nor to be of help in solving communication breakdowns, nor to indicate how the model may be used to write a better television show. He is interested only in the question of the relationship of measurement theory to communication. We may question the model on grounds regarding the accomplishment of this task, but we should not question the model on the grounds that it seems to be of no help in the problems of introducing technical change in underdeveloped countries of the world.

3.5.12 Neither the Shannon and Weaver formulation nor the Rothstein adaptation are of distinct help in gaining an understanding of the characteristics peculiar to human communication. Let us turn our attention to human communication, and focus on several models attempting to specify what happens to an individual receiver or destination of communication upon receipt of a message. The classic model for this formulation remains that of Ogden and Richards in their book *The Meaning of Meaning*. Ogden and Richards are interested in the relationships which hold between symbols or messages, thought, and the referents for symbols. They visualize the triangular diagram shown in Fig. 3.3, and then turn to a verbal description to explain their model:

3.5.13 This [relationship] may be simply illustrated by a diagram in which the three factors involved whenever any statement is made, or understood, are placed at the corners of the triangle, the relations which hold between them being represented by the sides. The point just made can be restated by saying that in this respect the base of the triangle is quite different in composition from either of the other sides.

3.5.14 Between a thought and a symbol causal relations hold. When we speak, the symbolism we employ is caused partly by the

[5]Reproduced with permission from figure 1, pages 9-10, *Communication, Organization, and Science*, Jerome Rothstein. Indian Hills, Colorado: The Falcon's Wing Press, 1958.

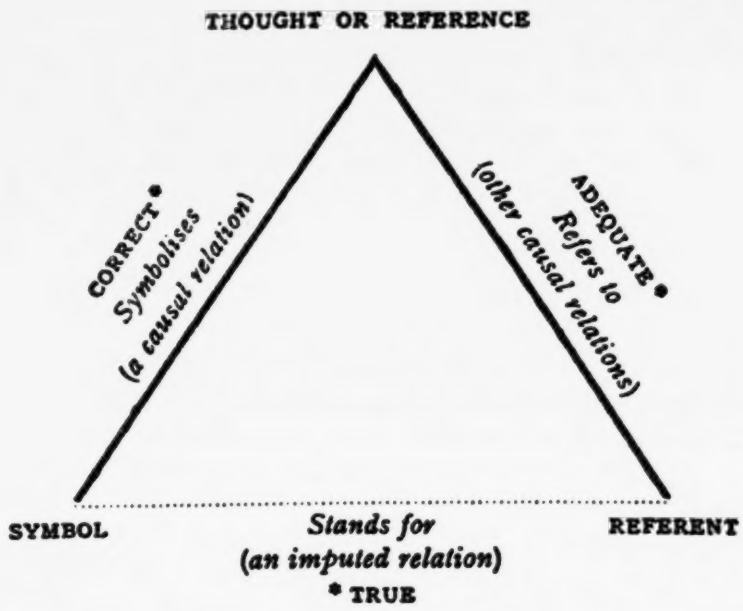


Fig. 3.3. The Ogden and Richards Model.[6]

reference we are making and partly by social and psychological factors — the purpose for which we are making the reference, the proposed effect of our symbols on other persons, and our own attitude. When we hear what is said, the symbols both cause us to perform an act of reference and to assume an attitude which will, according to circumstances, be more or less similar to the act and the attitude of the speaker.

3.5.15 Between the Thought and the Referent there is also a relation; more or less direct (as when we think about or attend to a coloured surface we see), or indirect (as when we 'think of' or 'refer to' Napoleon), in which case there may be a very long chain of sign-situations intervening between the act and its referent: word — historian — contemporary record — eye-witness — referent (Napoleon).

3.5.16 Between the symbol and the referent there is no relevant relation other than the indirect one, which consists in its being used by someone to stand for a referent. Symbol and Referent, that is to say, are not connected directly (and when, for grammatical reasons we imply such a relation, it will merely be an imputed, as opposed to a real, relation) but only indirectly round the two sides of the triangle.

3.5.17 Here again, the visual does not carry the entire model. A verbal description is necessary in order to understand fully what

[6]Reproduced by permission from pp. 10-11, *The Meaning of Meaning*, C. K. Ogden, and I. A. Richards. New York: Harcourt Brace and Company, Inc., 1956.

Ogden and Richards mean. There are other objections to this model on somewhat more technical grounds. Ogden and Richards never attempted to specify the term "thought" in any way, and the model may be criticized for lack of utility on that ground. Today, the Ogden and Richards formulations are mainly of historical interest.

3.5.18 In addition, the Ogden and Richards model stimulated development of a more sophisticated model which attempts to explain the same process of language use. Dissatisfied with the proposals of Ogden and Richards and with the model developed by Charles Morris in his book *Signs, Language, and Behavior*, Charles E. Osgood developed a model based on learning theory. Exactly the same process was under consideration, i.e., what are the relationships between observable stimuli and the observable responses of individual receivers. Yet the model as it appears in Fig. 3.4 is considerably more complicated. Its complexity enables the model to explain more completely what happens in the situation being studied. It is, with all the complexity, still a purely descriptive model. It attempts no predictions, and does not generate new propositions.

3.5.19 The model, as we present it here, was developed by Charles Osgood, and is explained by Wilbur Schramm in his book *The Process and Effects of Mass Communication*:

3.5.20 Begin with (1). This is the input. At the message level we have a collection of objectively measurable signs [S]. These come to your sense organs, where they constitute a stimulus for action. This stimulus we call s. When the process gets as far as s, you are paying attention. The message has been accepted. It may not have been accepted as intended; s may not equal [S]; the sensory mechanism may have seen or heard it incompletely. But everything else that happens as a result of the message in that particular destination will now necessarily be the result of the stimulus accepted by your sense organs.

3.5.21 Now look at number (2). The message may not have to go to any other level in order to bring about a response. If a man waves his fist near your nose, you may dodge. If he squeezes your hand, you may say "ouch!" These are learned, almost automatic, responses on the sensory and motor skill level.

3.5.22 But the stimulus may also bring about other kinds of activity within your nervous system. Look at number (3). The stimulus s may be translated into a grammatical response on your dispositional level — by which we mean the level of learned integrations (attitudes, values, sets. etc.) which make it so easy for you to dispose of the variety of stimuli

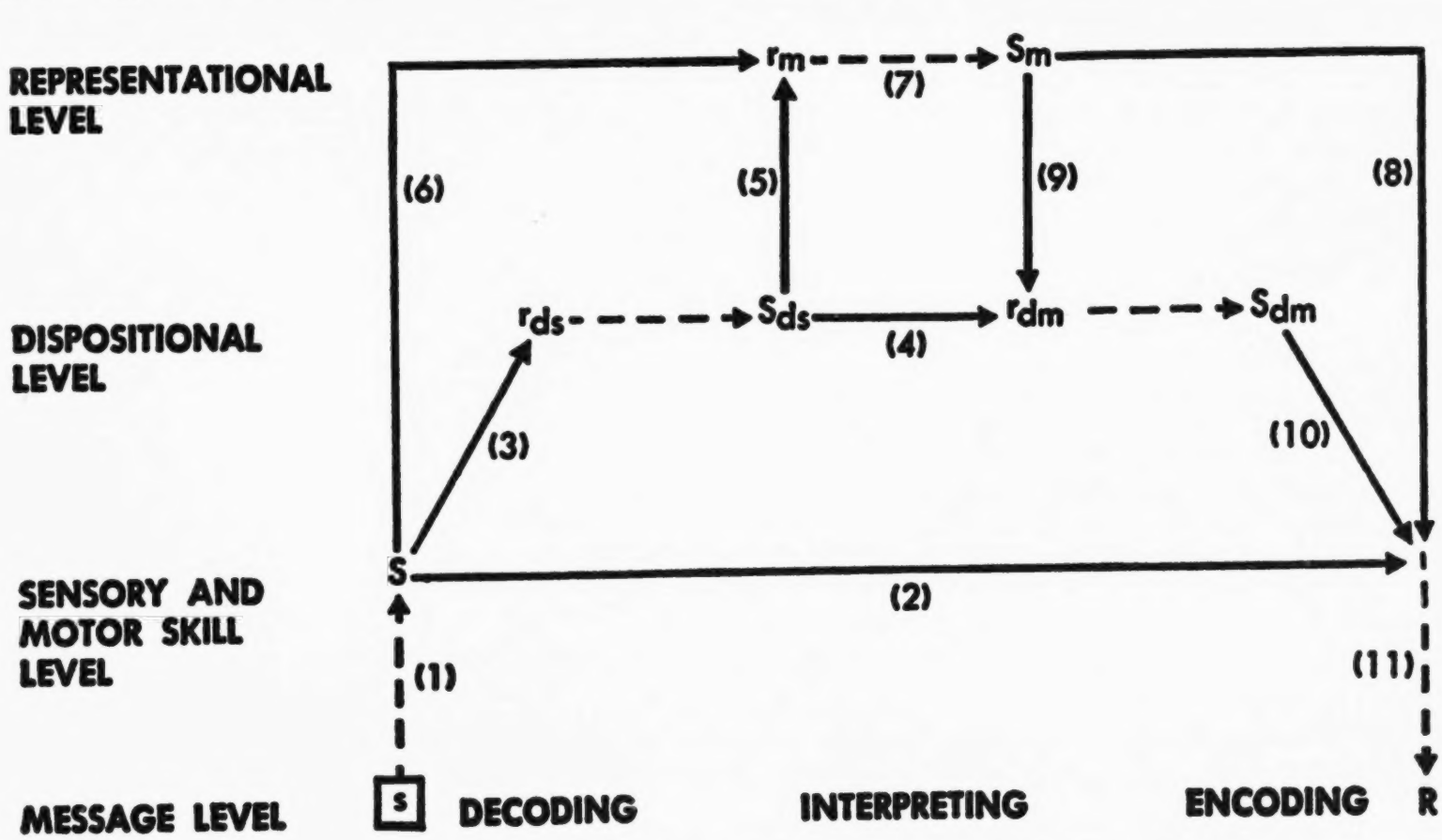


Fig. 3.4. The Osgood Representational - Dispositional Model.

that come to you in the course of a day. These are what we call the intervening variables. Suppose the stimulus stirs up activity in this area of intervening variables. Two things may happen. Look at number (4). The response may be so well learned that it doesn't even have to go to the level of thinking. You hear a line of a poem, and almost automatically say the second line. In that case the activity is through numbers (4) and (10).

3.5.23 More often, however, the activity goes through number (5). Here the original stimulus has been decoded into grammar, fed through the intervening variables, and sent up to the representational level of the central nervous system where meanings are assigned and ideas considered. Occasionally a stimulus comes to that level without going through the intervening variables—as in number (6). These stimuli create activity in the central nervous system (r_m) which is the terminus of the decoding part of the process. This is equivalent to the meaning or significance of the signs [S]. What happens in number (7), then, is what we have been referring to as interpretation. The response r_m which we call meaning becomes in turn a stimulus which sets the encoding process in action, so that (7) is both the terminus of decoding and the start of encoding. We learn to associate meanings with desired responses. And so the encoding process moves through (8) or (9). That is, we give certain orders which either pass directly to the neuromuscular system (through 8) or are passed through the intervening variables (through 9 and 10). In any case, all this activity of the nervous system finally results in a response on the motor skill level (r), which results in output

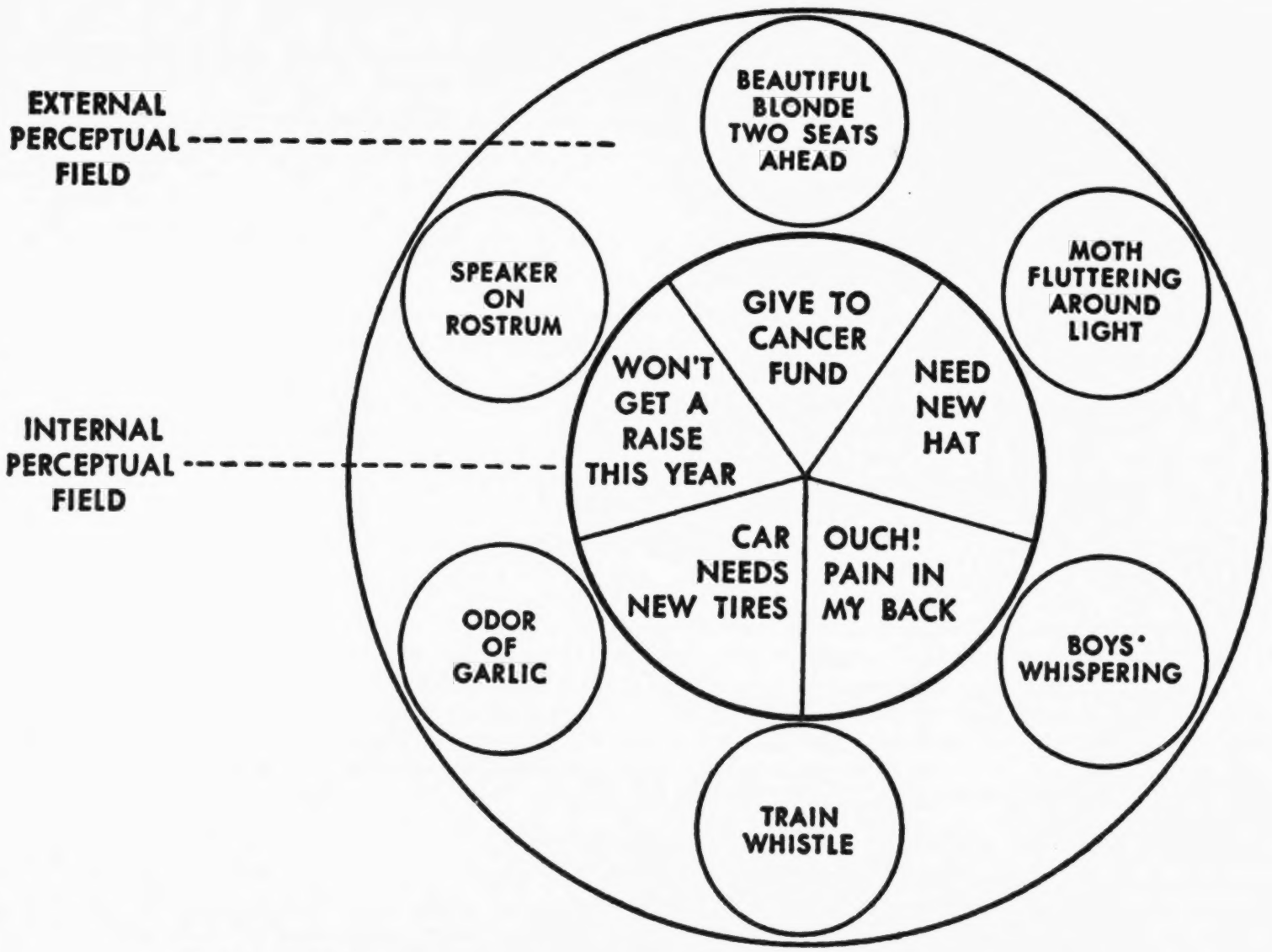


Fig. 3.5. This is the perceptual field of a hearer. It consists of all the stimuli he could possibly attend to. (Number of available stimuli is drastically reduced for convenience.) Reproduced with permission from page 39, *The Arts of Persuasion*, Wayne C. Minnick, Boston, Massachusetts: Houghton Mifflin Co., 1957.

(number 11). If the output is an overt response (R), then we have another message, which may offer itself as a collection of signs [S] and be accepted by still another person as a stimulus (s).[7]

3.5.24 The Osgood model is probably not understandable without a verbal description explaining the relatively unfamiliar symbols and relationships expressed in the model. We can turn now to a model which needs little verbal description, yet which attempts to explain some of the same things as the Osgood model. This visualization, developed by Wayne Minnick for his book *The Art of Persuasion*, shows visually the complexity of the perceptual field surrounding the listener. For Osgood, the internal perceptual field as Minnick shows it would be shown by the internal $s_m - r_m$ cycles, while the external perceptual field is seen by Osgood as part of the message (no. 1 in Fig. 3.4). Minnick's model is easy to understand at a glance. Osgood's model is considerably harder. The Minnick model is limited in usefulness in that no attempt is made to show visually what the end result is of the complexity of stimuli affecting the listener, i.e., how the competing stimuli affect the listener's final perception.

3.5.25 When we look at the three models presented by Ogden and Richards, Osgood, and Minnick certain relationships and weaknesses are apparent. None of the models deals specifically with the complete communication process having the elements of source, message, channel and receiver as does the Shannon and Weaver model. It is certainly true that each of the models is constructed in such a way that additions to the model would provide for a more complete description of the communication process, but as we have them, the models are not complete. Their usefulness lies in the fact that each model was constructed to describe a specific aspect of the entire communication process. The visualizations do not attempt to show the process nature of communication, nor do they illustrate by themselves even the portion of the process being considered. For usefulness in teaching, each visualization would have to be accompanied by a verbal explanation.

3.5.26 The next models which are examined all make an attempt to show the process nature of communication. They all attempt to show communication between two persons, specifically oral communication. Basically, each model consists of the elements described by Schramm, placed in a context which emphasizes the social nature of communication, the learned nature of communication, or the perceptual nature of communication.

3.5.27 The first model is one developed by Wendell Johnson and published in the *Harvard Business Review*. Johnson's model, together with its accompanying explanation, may be characterized as a primarily physiologically based model. Johnson is not interested in attitudes, social situation, speaker skills, or message organization. He is interested in describing the main elements of communication, and in the ways in which these elements would appear from a physical point of view. His model, Fig. 3.6, below, emphasizes the fact that communication is not one way, but a constantly changing process in which the source becomes the receiver and vice versa. Certainly, to show the process nature of communication, and the interrelationships of the physical and physiological elements of oral communication, the Johnson model would be most useful.

3.5.28 The main objection to the Johnson model is that it does not attempt to specify what happens within the sending or receiving organism to cause the messages to be encoded or decoded in certain ways. A more specific formulation and adaptation of the Johnson model is

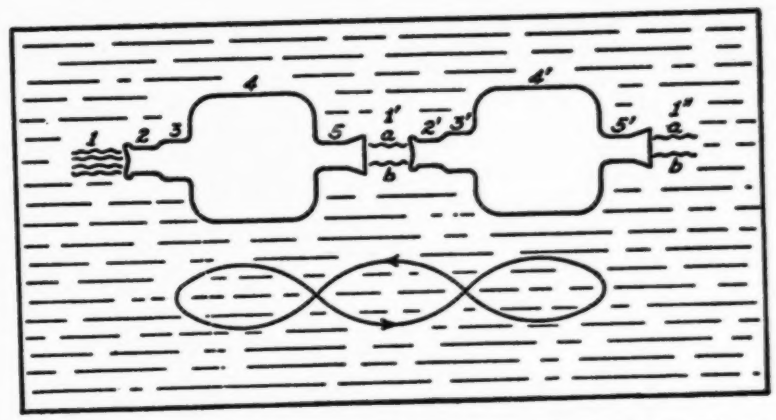


Fig. 3.6. The Johnson Model. KEY: Stage 1, event, or source of stimulation, external to the sensory end organs of the speaker; Stage 2, sensory stimulation; Stage 3, pre-verbal neurophysiological state; Stage 4, transformation of pre-verbal into symbolic forms; Stage 5, verbal formulations in "final draft" for overt expression; Stage 1′, transformation of verbal formulations into (a) air waves and (b) light waves, which serve as sources of stimulation for the listener (who may be either the speaker himself or another person); Stages 2′ through 1″ correspond, in the listener, to Stages 2 through 1′. The arrowed loops represent the functional interrelationships of the stages in the process as a whole. Reproduced by permission from exhibit 1, p. 50, "The Fateful Process of Mr. A. Talking to Mr. B," by Wendell Johnson, in *How Successful Executives Handle People*, published by *Harvard Business Review*, Cambridge, Massachusetts, 1953.

[7]Reproduced with permission from pp. 11-12, *The Process and Effects of Mass Communication*, Wilbur Schramm. Urbana, Illinois: University of Illinois Press, 1954.

provided in a visualization created by Halbert Gulley for a course in Contemporary Theories of Oral Communication taught at Illinois. Essentially the Gulley model attempts to combine elements of the Johnson model with elements of the Osgood model. Thus Fig. 3.7 includes all stages of the Johnson model but adds to the visualization the mediation concepts introduced by Osgood. Again the model emphasizes the process nature of communication and attempts to specify the nature of the relationships between the perception of an object, and the final message encoded by the speaker about that object.

3.5.29 The Gulley model is weak in the same way that the Osgood formulation is weak. It does not specify the nature of the mediating processes occurring within the source of receiver. For what it attempts to do, the Gulley model appears to link the process nature of communication as stressed by Johnson with the Osgood hypotheses in a rather efficient fashion.

3.5.30 A final model of oral communication is perhaps the most interesting. This model is provided by Donald Bryant and Karl Wallace in their book *Fundamentals of Public Speaking*. Bryant and Wallace emphasize the fact that there is a process at work not only between the speaker and the listener, but within both speaker and listener. The effect of perception on both speaker and listener is stressed, and stressed rather specifically. The two-way nature of communication is pointed out with an arrow that indicates that the listener's response serves as a stimulus for the speaker. Fig. 3.8 appears to be almost totally different in form from either the Johnson model or the Gulley model, but actually the elements of the model are the same. The visualization is different and perhaps will serve a somewhat different purpose in a teaching situation.

3.5.31 We can make some summary statements about these three models emphasizing the nature of oral communication. First, each one attempts to show that communication is a process. Second, each one emphasizes that communication is more than one-way. Third, none of the models attempts to describe the nature of the message. And last, none of the models attempts to

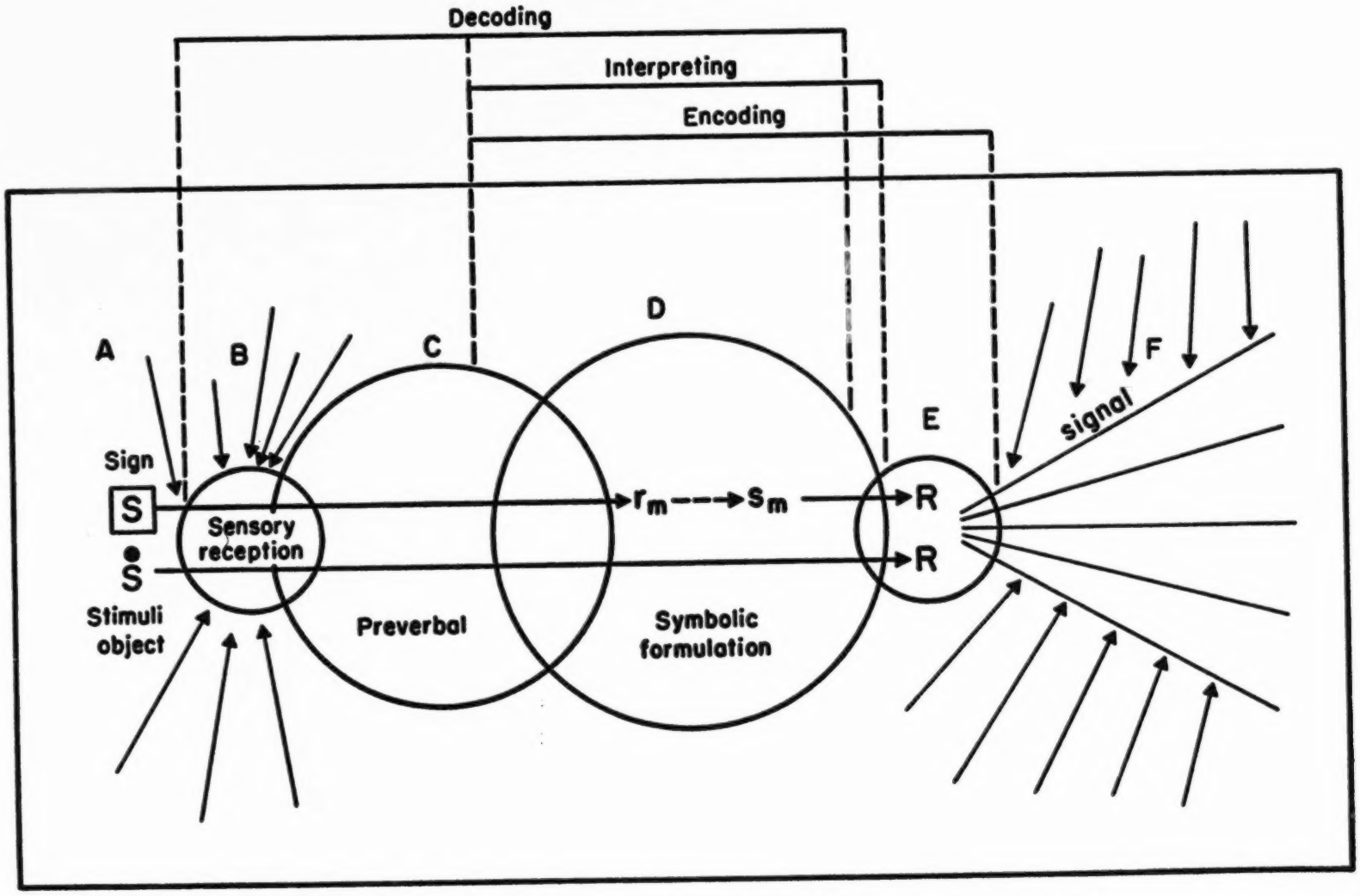


Fig. 3.7. The process of speaker addressing audiences: the Gulley Model.

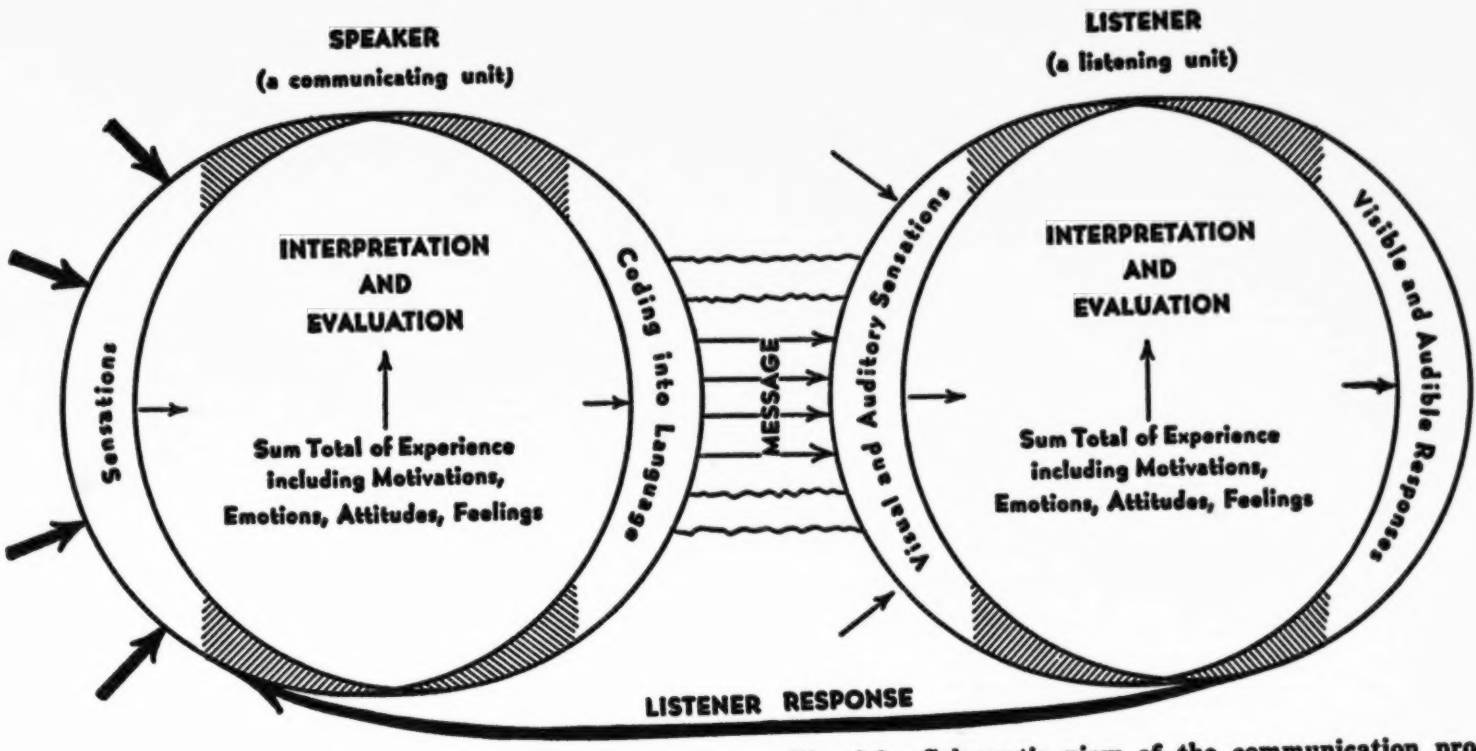


Fig. 3.8. Schematic view of the communication process.

Speaker: a stimulating unit whose output (speech and action) during transmission (delivery) is the product of whatever has stimulated him. His sources of stimulation, represented by the heavy arrows, are (1) his total experience prior to delivery (including knowledge of his listeners) and (2) signs of listener response during delivery.

Listener: a receiving unit whose *input* is speech and action from the speaker and sensations from the listening environment. The listener is also a responding unit whose output is determined by what comes into him (the input) modified by his total experience. His responses (speech and action) may occur during listening and following listening.

Reproduced by permission (October, 1959), from Fig. 1, p. 15, *Fundamentals of Public Speaking*, by Donald C. Bryant, and Karl R. Wallace. New York: Appleton-Century-Crofts, Inc., 1947.

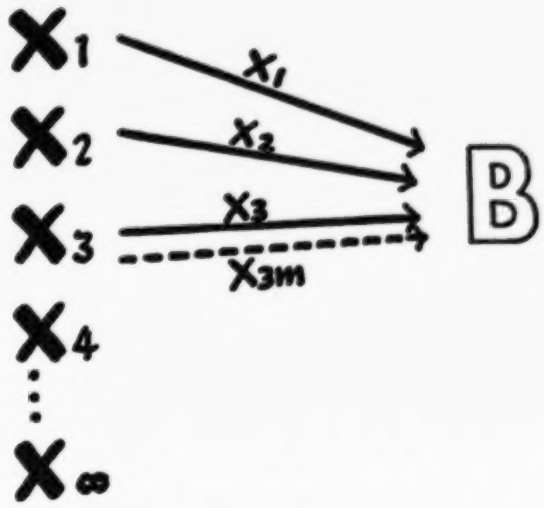
describe communication through any channel other than the face-to-face, two-person situation.

3.5.32 Bruce Westley and Malcolm MacLean, Jr., have introduced a model applicable to the mass media situation, where communication involves more than two people. Fig. 3.9 below shows the model as they formulate it in four stages. The first stage would correspond most closely to the Minnick model (Fig. 3.5), and reports the process by which individuals select events from the real world by direct perception. The second stage is analogous to the three models presented by Johnson, Gulley, and Bryant and Wallace, showing the process of communication as it flows through a second individual A. The third stage points out that individuals cannot have contact with all the available environment and must depend for information on the messages produced by an individual C, who selects items which he has perceived and transmits some of them to B. And the fourth stage shows what typically happens in a mass media situation, as well as being applicable to several other kinds of communication situations. Here, the events that have been sampled by A are reported to C who in turn reports them to B. Neither C nor B have actually seen the events but can share in them through A. Thus we have the situation where the reporter on a newspaper, or the news commentator on radio, can give information to members of an audience.

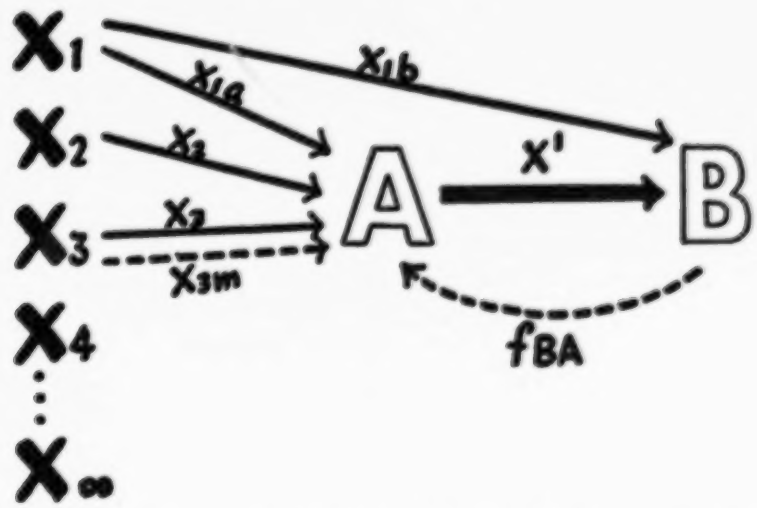
3.5.33 The Westley and MacLean model does not attempt to specify what happens within the individual, i.e., what the mediating reactions of either the source or the receiver are. It does not attempt to say anything about the nature of messages which are passed along to various kinds of receivers. But the model is extremely useful in that the relationships between a large number of individuals within the culture can be isolated with the model, their functions described, and their roles analyzed. The model emphasizes the process nature of communication and introduces the term feedback as an explanation of certain phenomena. By presenting the model in four stages, Westley and MacLean ease the teaching burden and make a rather useful model to describe a large number of communication events.

3.5.34 Westley and MacLean deal, as have all the other models which we have discussed, with individuals. The previous models are

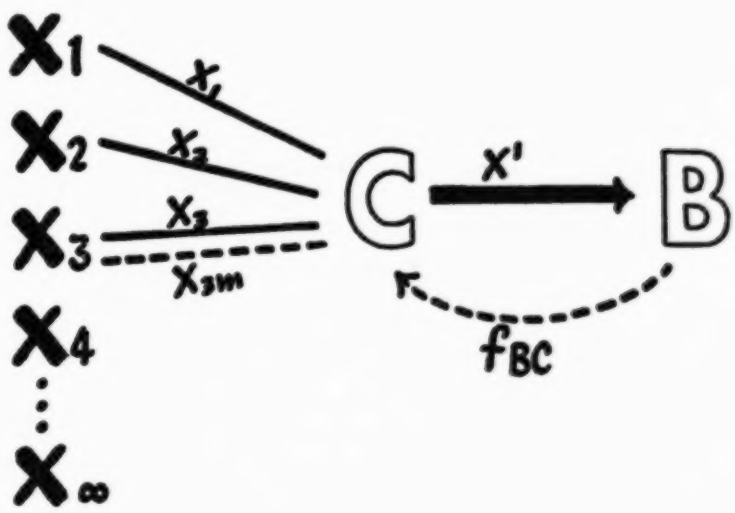
Fig. 3.9. The Westley-MacLean Model.



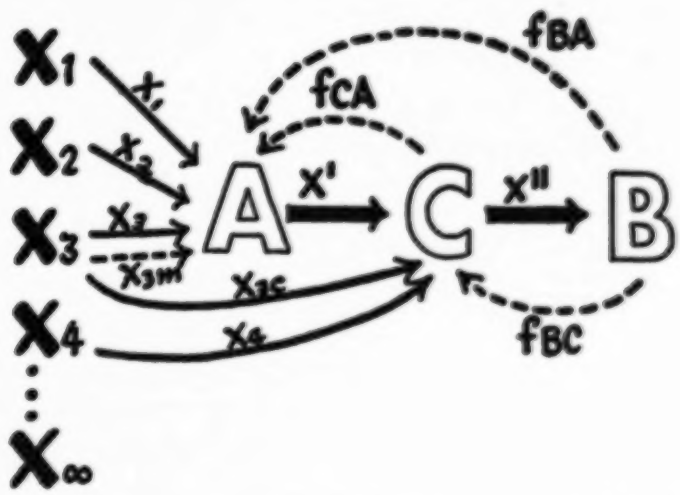
Objects of orientation (X_1 . . . X_{00}) in the sensory field of the receiver (B) are transmitted directly to him in abstracted form (X_1 . . . X_3) after a process of selection from among all Xs, such selection being based at least in part on the needs and problems of B. Some or all are transmitted in more than one sense (X_{3_m}, for example).



The same Xs are selected and abstracted by communicator (A) and transmitted as a message (X′) to B, who may or may not have part or all of the Xs in his own sensory field (X_{1_b}). Either purposively or non-purposively B transmits feedback (fBA) to A.



What Xs B receives may be owing to selected abstractions transmitted by a non-purposive encoder (C), acting for B and thus extending B's environment. C's selections are necessarily based in part on feedback (fBC) from B.



The messages C transmits to B (X″) represents his selections from both messages to him from A's (X′) and C's selections and abstractions from Xs in his own sensory field (X_3c, X_4), which may or may not be Xs in A's field. Feedback not only moves from B to A (fBA) and from B to C (fBC) but also from C to A (fCA). Clearly, in the mass communication situation, a large number of Cs receive from a very large number of As and transmit to a vastly larger number of Bs, who simultaneously receive from other Cs.

Reproduced by permission from pp. 32-35, "A Conceptual Model for Communications Research," by Bruce H. Westley and Malcolm S. MacLean, Jr., *Journalism Quarterly*, Winter, 1957.

obviously extendable to groups of people, but the models do not attempt to indicate the relationship of individuals within communication situations to various kinds of social groupings. Riley and Riley, in an article appearing in *Sociology Today*, present a model which can be said to have a sociological basis as an explanation of the communication process. Fig. 3.10 shows the social influences at work on any communicator (C) and on any receiver (D), and places communication within a social framework.

3.5.35 Riley and Riley explain the model (p. 27) in a short verbal statement:

". . . the two interdependent structures of C and of R [are shown] as aspects of the same wide society and the same secular trend, which is represented by the

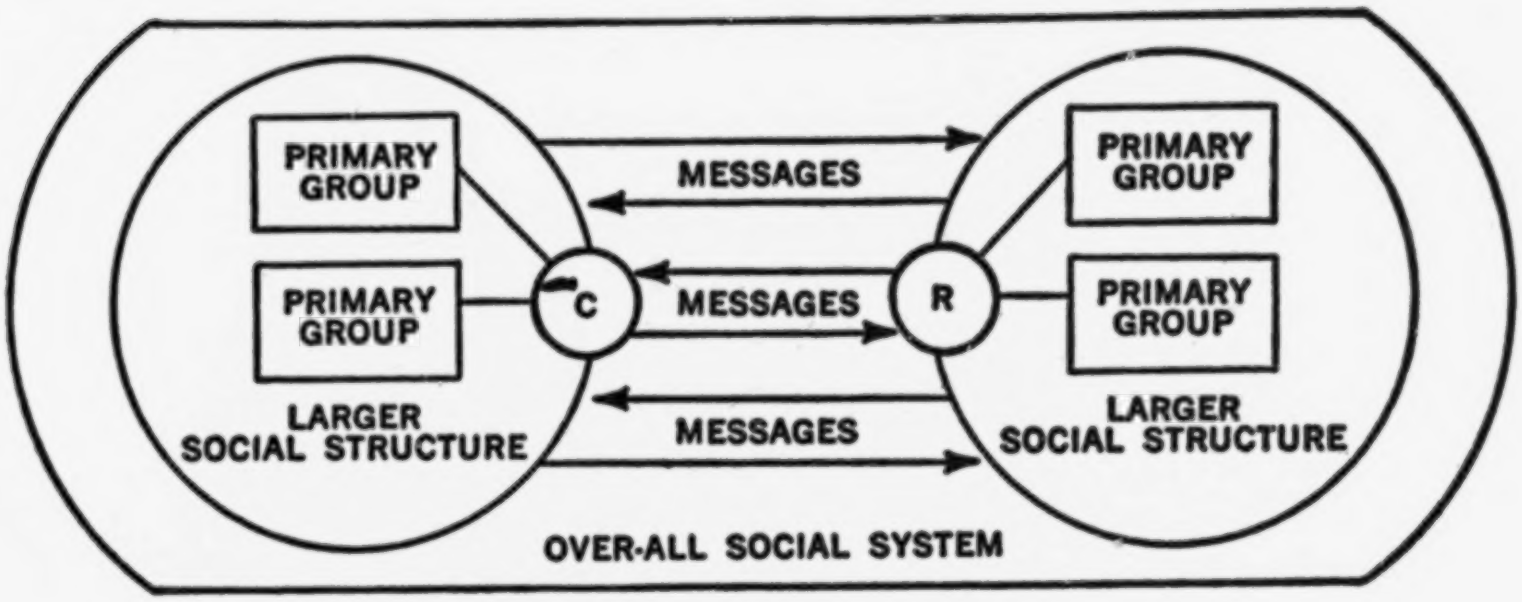


Fig. 3.10. The Riley and Riley Model.

oval boundary which encompasses them both. The several arrows indicate the flow of communication back and forth among the several members of these interdependent structures. Within such an all-embracing system, the mass-communications process is now seen as a component of the larger social process, both affecting it and being in turn affected by it."[8]

3.5.36 This model again does not attempt to analyze the character of messages which might occur within communication, nor to discuss the nature of channels which might carry those messages. It merely emphasizes that even though communication may seem to occur between two individuals, effects of the culture and the group affiliations of both source and receiver will affect the nature of the communication produced and the communication received.

3.5.37 As a final visual model in this section we turn to a model prepared by Carl Hovland and his associates for their book *Personality and Persuasibility*. This is an entirely different kind of model from those we have discussed before. In one sense it is not a model, but merely a classification of factors affecting attitude change in certain kinds of communication situations. But the category scheme (Fig. 3.11) becomes a model when the relationships between the various factors are indicated as they are by arrows showing the kinds of effects expected from different levels of analysis. The model is used by Hovland and associates as a rationale for organization of several experimental studies examining effects at different levels. The model might equally well be used to organize a course attempting to study communication effects in persuasive situations.

3.5.38 Note that the Hovland model does not attempt to specify the exact relationships existing between various factors. Nor does it attempt to show the dynamic character of communication. Essentially, the model says that communication can be studied with several approaches, and that there are relationships which exist between the approaches.

3.5.39 In this section, we have looked at three models of the communication process. Our examination has necessarily been brief. Yet it is apparent that no one model describes or even attempts to describe everything that goes into communication. Any model is selected for a particular purpose and emphasizes those aspects of the process of communication which are being studied by the individual formulating the model. Models may be primarily verbal, i.e., linguistic descriptions such as those of Aristotle and Lasswell, or primarily visual, such as the Bryant and Wallace model. Or they may combine a visualization with a verbal description, such as is done by Shannon and Weaver.

3.5.40 In the following chapters, we wish to discuss in detail two additional models which have been used extensively in communication training. We shall concentrate on the ways in which they may be used in teaching communication theory, analyzing communication breakdowns, and improving communication between individuals.

[8]Reproduced with permission from figure 4, pp. 576-577, *Sociology Today*, (eds.) Robert K. Merton, Leonard Broom, and Leonard S. Cottrell, Jr., New York: Basic Books, Inc., 1959.

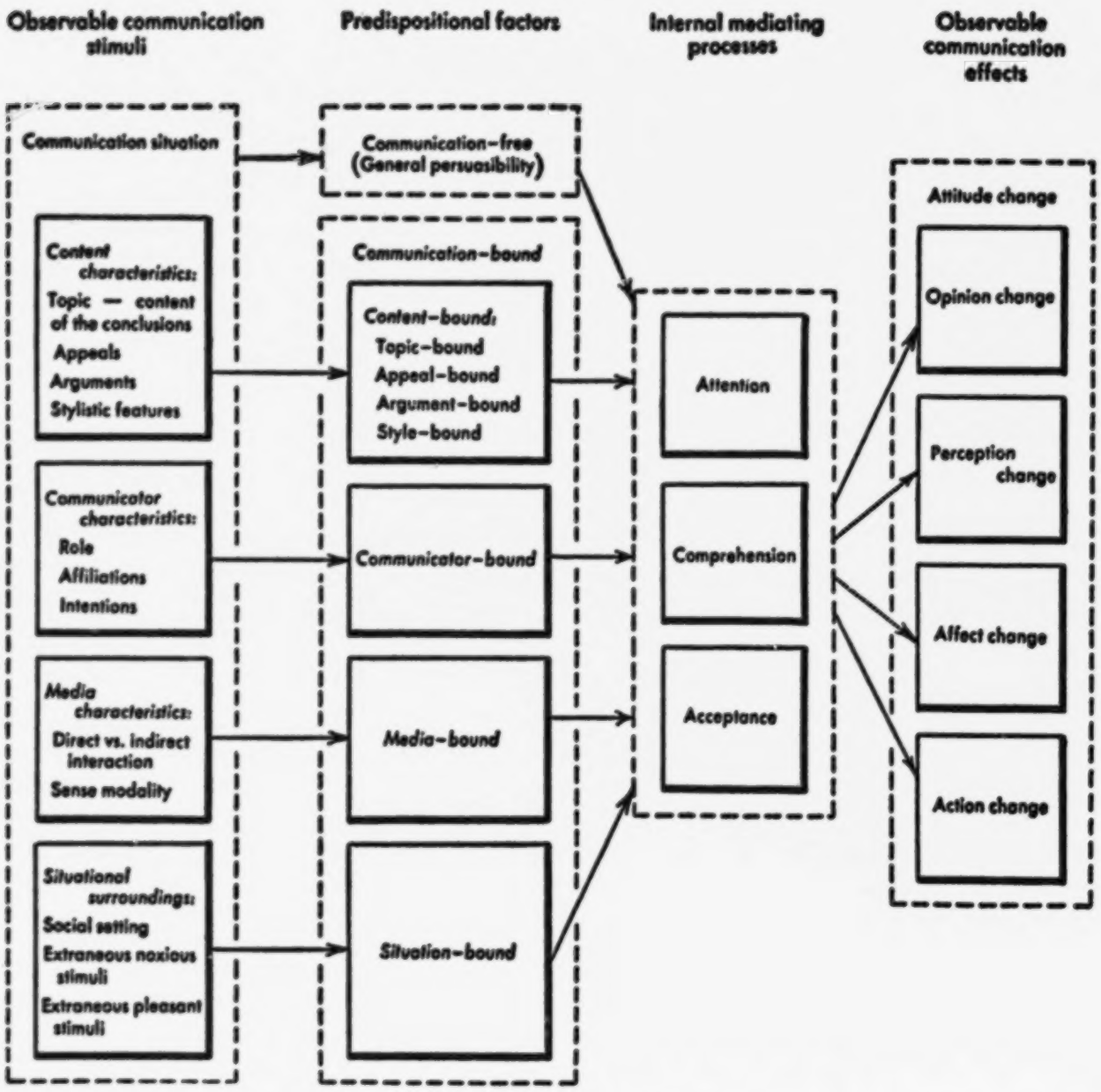


Fig. 3.11. Major factors in attitude change produced by means of social communication. The categories and subcategories are not necessarily exhaustive, but are intended to highlight the main types of stimulus variables that play a role in producing changes in verbalizable attitudes. Reproduced by permission from figure 1, page 4, *Personality and Persuasibility*, Carl I. Hovland, (ed.), New Haven: Yale University Press, 1959.

4. The S-M-C-R Model of Communication

prepared by Erwin P. Bettinghaus

4.1 Purposes and Use

4.11 The S-M-C-R Model, developed by David K. Berlo and used in training programs of the National Project in Agricultural Communications, emphasizes the psychological nature of communication as it affects both the source and the receiver in any communication situation. Although other models have also emphasized the psychological nature of communication, the S-M-C-R Model has the special characteristics of providing an analysis of messages and of sensory channels in communication.[1]

4.12 Essentially, this model (Fig. 4.1) attempts to portray the necessary ingredients for human communication. The model has been used in the teaching situation to improve understanding of the communication process, as well as to help students or workshop participants improve their ability to understand others or to have others understand themselves. With slight additions, the model has been used to analyze communication breakdowns.

4.2 The Source

4.21 With these uses in mind, let us look at the model portrayed in Fig. 4.1 in some detail. All communication involves a *source* of information, the (S) within the model. The model does not specify what kinds of sources can produce messages, and depending on the situation, it is obvious that communication stems from many kinds of sources. In human communication, the source can be a single individual, such as a speaker talking to a large audience. But the source can also be a group of people, such as the American Legion, or the United States Department of Agriculture, or an institution such as Michigan State University. Even though these institutions are obviously composed of individuals, yet the communications which they engage in frequently appear to a listener or a group of listeners as stemming from a single source. Thus we may hear such statements as "The government sent me an income tax form today," or "The USDA reported today on the farm crisis."

4.22 Once the fact is established that communication always involves some source, we can examine these possible sources of communication to ask questions about the significant factors within sources affecting the communication process. It is certainly possible to develop a relatively long list of factors specific to individual situations, or even common to several situations. However, when we begin applying our list to many sources, we will find that not all of the items will be significant variables in all situations. The S-M-C-R Model provides a minimum list of significant variables which should be applicable to most of the kinds of communication situations which interest us.

4.23 For example, we can say that the *communication skills* of different sources will be important factors in determining the success of communication in any situation. The ability to write, to draw, to speak, will differ as the source in the communication situation differs. And perhaps more important than these encoding skills is the ability to reason, which again differs with the source.

4.24 Communication skills are clearly important to the success of communication; if sources cannot encode messages which are understandable to receivers, communication may break down. When two sources are talking about the same situation, both sources may be able to encode understandable messages for a particular receiver. In general, however, the source with the more highly developed communication skills will be a more effective communicator than will the source with less highly developed communication skills.

[1]The S-M-C-R and Interpreter models (Chapter 5) are discussed in detail in *The Process of Communication: An Introduction to Theory and Practice*, by David K. Berlo. New York: Henry Holt and Company, 1960.

4.25 A second factor within the source producing differential effects in a communication situation is the source's *attitudes*. Here we can talk about several kinds of attitudes, each one important to the total process of communication. Attitudes have been defined variously by psychologists. Perhaps the most widely accepted definition of an attitude is that it is a "predisposition to response in any situation." In communication, the source has attitudes toward the receiver of communication — his audience. The source has attitudes toward the subject about which he is communicating. He may have attitudes toward the channel (for example, a prejudice for or against use of visuals). And the source has attitudes toward himself. This entire complex of attitudes is important to the success of communication.

4.26 If the source has an unfavorable attitude toward his receiver, we might expect that his communication will be different than if he is highly favorable toward the receiver. If the source is unsure of himself, again the resulting communication may be different than if the source is confident of his own abilities. The source may hold an unfavorable attitude toward the room where the communication is taking place. He might be somewhat neutral toward the subject about which he communicates. In each case, a consideration of the attitudes of the source is important if we are to understand the process of communication.

4.27 In teaching, it is important to let students see that even though complete analysis of all the relevant attitudes present in any communication situation may be impossible, the source who wishes to become an efficient communicator must attempt such an analysis. Entering a communication situation with little knowledge of the relevant attitudes is inviting a communication breakdown.

4.28 A third factor which seems to enter into all communication situations is *knowledge*. Here we can talk about the source's knowledge of his subject matter and about his knowledge of the audience; these are the knowledges that are generally referred to when we say that the well-informed source is likely to be more successful than the poorly-informed source. However, it is important in addition to know something about the situation in which communication is taking place, as well as something about the process of communication itself. The model we are discussing emphasizes the fact that knowledge of all aspects of communication is necessary.

4.29 A final over-all factor which we must consider in analyzing communication is the *social-cultural context* in which the source and his receivers are living. Here we can ask ourselves a number of questions. What is the role of the source within society? What groups does he belong to? How do those groups influence him as a communicator? What special aspects of the

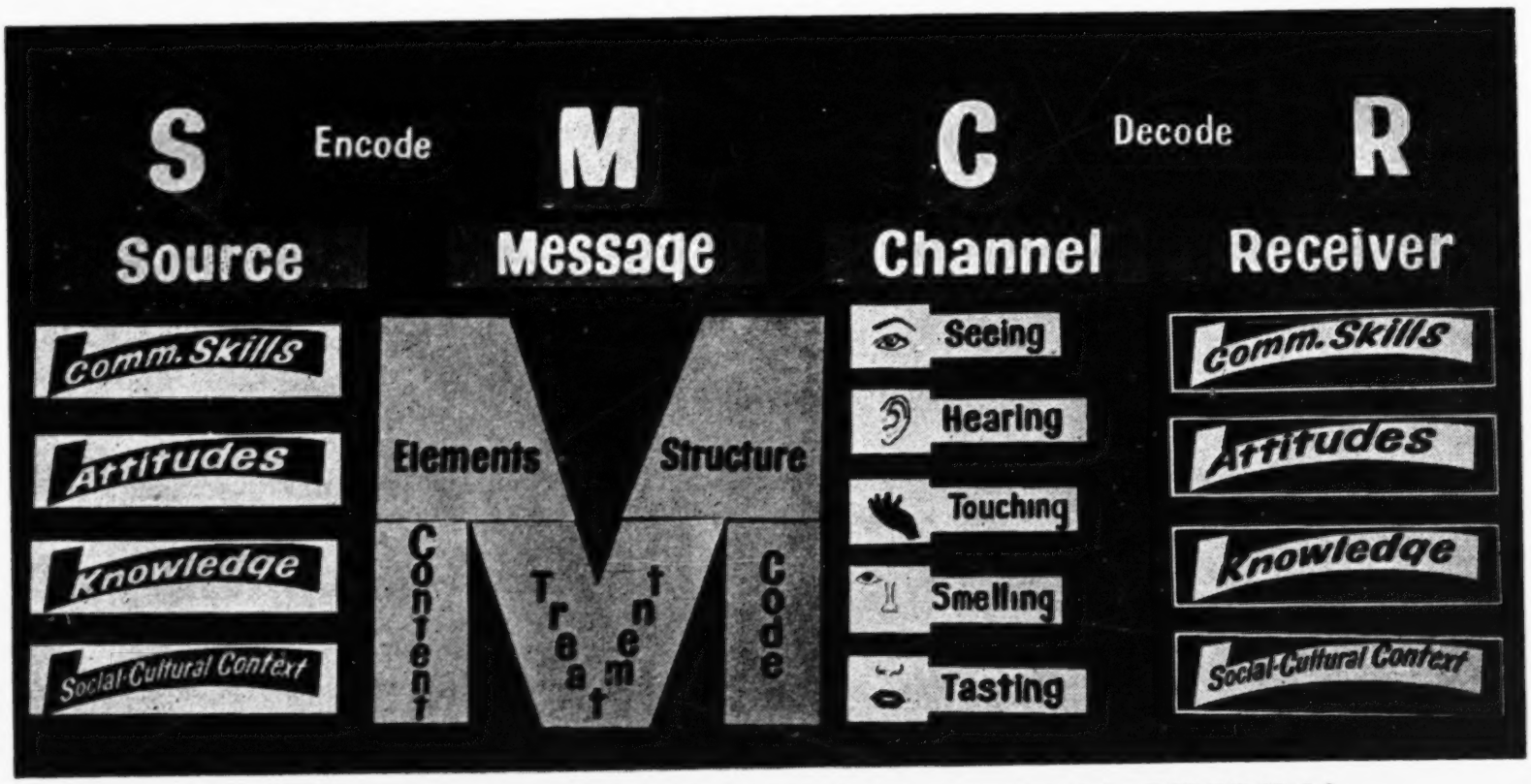


Fig. 4.1. Photograph of a flannelboard presentation of one version of the S-M-C-R Model.

culture condition the communication which the source might encode? These and similar questions affect the total process of communication as we have described it.

4.3 The Receiver

4.31 Just as there is a source in all communication situations, so there is also a *receiver* in all such situations. We can make much the same analysis of the receiver as we do of the source. People serve both as sources and receivers of communication. At one and the same time, an individual might be talking to another, i.e., acting as a source for communication, and also be watching the facial expressions of the other, i.e., acting as a receiver of communication. Since this is true, we might expect sources and receivers to have much the same characteristics. We can talk about the *attitudes* of the receiver, the *communication skills*, the *knowledge*, and the *social-cultural context* of the receiver in the communication situation in the same ways in which we talked about these factors operating within the source of communication.

4.32 The *attitudes* of the receiver will condition the effectiveness of the source quite apart from the source himself. If the receiver is negative toward the source, communication is much less likely to be effective than if the receiver is highly favorable toward the source. It is clearly a different communication situation when the receiver is against the proposal made by the source, from when he has already made up his mind that he is in favor of it. In general, we can say that the closer the match between the attitudes of the source and the attitudes of the receiver, the more effective the communication.

4.33 The *knowledge* of the receiver is obviously important. The receiver placed in a communication situation involving a completely new subject behaves differently from one entering a relatively familiar situation.

4.34 The *communication skills* of the receiver may drastically affect the success of communication. The skills required to be an effective receiver are somewhat different from those required to be an effective source. When we consider the receiver, we are concerned with the decoding skills of reading, listening, and of course thinking. When the reading ability of the receiver is limited, the effectiveness of the source attempting to communicate by writing will also be limited. As a general conclusion, we can suggest that the closer the match in communication skills between the source and receiver, the more effective will be the communication.

4.35 Finally, we must realize that the receiver of communication also lives within a *social-cultural context*. He belongs to certain groups and does not belong to others. He has a cultural heritage which determines in large part the ways in which he behaves. He refers to some groups for guidance in communication situations and does not refer to others. Communication will break down if there are no common elements between the social-cultural context of the source and that of the receiver.

4.36 Like the source, the receiver within the communication situation may be a single individual. The receiver may be within a group of individuals, such as the audience at a play. Or the receiver may also be an institution, such as a labor union, a university, or a government.

4.37 In teaching students or workshop participants about the process of communication, it seems desirable to deal with both the source and receiver of communication before turning to other elements within communication. Our orientation is usually toward ourselves as sources or ourselves as receivers of communication; we tend to identify communication solely in terms of the characteristics of the sources and receivers within the process. The S-M-C-R Model differs from all models mentioned in the previous chapter in that it emphasizes the complete process of communication, and deals with source and receiver as only two elements of communication.

4.4 The Message

4.41 The *message* in communication may be considered from several different viewpoints. The model attempts to break the message element down into meaningful sub-elements for more complete understanding. The teacher may talk about the factors important to the source and receiver in any order. When we talk about the message, however, it probably makes more sense to follow the order of presentation developed below.

4.42 The first thing which we should mention is the term *code*. All messages involve some code. We can talk about German, French, Hindi, or English as being different codes. Or we can talk about music, art, or the dance as involving different codes. Or we can talk about the specialized codes we call jargon within a language such as English. Thus the physicist has

a code peculiar to his field, even though the words within this jargon are recognized as English words.

4.43 Second, we can mention the *content* of a message. It is certainly true that code and content are inextricably linked within the communication process. For teaching purposes, we separate them for consideration as separate elements. Content involves the ideas within the message. For a given subject such as atomic energy, there will be many ideas for a source to draw from in encoding some message. The source has to select content appropriate to his audience. He must find an arrangement of the material he selects. And he must test those ideas for usefulness with a particular receiver.

4.44 Given a code and some content, the speaker or source within a communication situation has to find an appropriate *treatment* for the ideas which he has selected. This is the primary task of the rewrite man, the editor, the movie director, of the advertiser; all are treatment specialists. Treatment involves selection of a code appropriate to the receiver, the content of the message, and the medium of transmission. Treatment involves the arrangement of sentences, the difficulty level of written material, and the appearance of the final product.

4.45 Within each subfactor of code and content and treatment, we need to consider the component *elements*. The elements of the English language might be words, or phrases, or units of sound. Ideas are the elements of any given content. After we know what elements are involved, we need to consider the *structure* of the message: the way the elements of the message are arranged or ordered.

4.46 In teaching, a consideration of the message as an integral part of the process of human communication is important to anyone attempting to improve his understanding of the process as a whole, as well as to anyone attempting to analyze communication breakdowns, or improve his own communication ability.

4.5 The Channel

4.51 The other major factor which the S-M-C-R Model deals with is the channel in communication. There are several ways in which we can look at channels of communication. The model shows only one of those ways. It suggests that one useful way of approaching the study of the communication process is to consider channels to be the five senses. Thus, the message can be *heard*, or *seen*, or *touched*, or *tasted*, or *smelled*. There are at least two other ways in which channels have been considered by those interested in a study of communication. We could talk about the message passing to the receiver as a pattern of sound waves or a pattern of light waves. Or we can talk about the disseminating channels of television, radio, newspapers, books, magazines, bulletins, etc.

4.52 A factor worth emphasis in teaching communication is the importance of multiple channels. When sources utilize more than one channel of communication, the chance for communicative effectiveness is generally increased. For example, we can indicate that research tends to show that when a speech is supplemented by appropriate visuals, the receivers of the communication tend to learn the material better than if the presentation uses only the channel of hearing.

4.6 Final Considerations

4.61 There are two other words on the model which we have used, but not defined. We can sum up the model as it appears in Fig. 4.1 by saying that communication always involves a source who or which *encodes* a message for transfer along some channel to be *decoded* by a receiver.

4.62 The S-M-C-R Model is useful for gaining some initial understanding of the process of human communication. However, it should not be used without the consideration of some precautionary measures designed to prevent misunderstandings. For example, the model does not indicate the purposive nature of human communication. In many ways, we can distinguish human communication from all other communication by indicating that human communication always involves purpose on the part of both source and receiver: there is no communication without purpose.

4.63 A second caution involves the nature of communication as a process. As the visual model is shown, it may appear to the casual observer that communication is a linear process, perhaps even a step-by-step process, always going in one way. Yet we know that communication situations are seldom one-way. The teacher of communication does well to emphasize that communication does not occur as simply as the visualization presented in Fig. 4.1 would seem to indicate. Communication, like all process, is dynamic, occurs in more than one direction, is ongoing, and is ever changing.

5. The Interpreter Model

prepared by Erwin P. Bettinghaus

5.1 Analysis

5.11 The Interpreter Model (Fig. 5.1e) was developed by David K. Berlo and has been used by the National Project in Agricultural Communications in training programs. The usefulness of the Interpreter Model lies in its attempt to link the learning process with the communication process in human behavior.

5.12 In making the same kind of analysis of the Interpreter Model as we have made of the S-M-C-R Model, we can start by saying that whenever humans learn or humans communicate, some *stimulus* is present (see Fig. 5.1a). We can define the term "stimulus" in rather broad terms to take in anything which we can perceive through one of our five senses. Thus a dog, a speech, a book, a tree, or a man walking all serve as stimuli for our senses. We can also point out that whenever there is a stimulus, there is also some *response*. By response, we mean simply that the individual perceiving a stimulus does something, i.e., votes, runs away, talks, thinks, changes an attitude, etc. Both learning and communication involve stimuli and responses.

5.13 If learning is to take place, the individual has to both *decode* the stimulus and *interpret* the stimulus (see Fig. 5.1b). Human beings have decoding apparatus in the senses of hearing, touch, taste, smell and sight. For example, the organism takes a pattern of sound waves striking the ear drum and translates it into

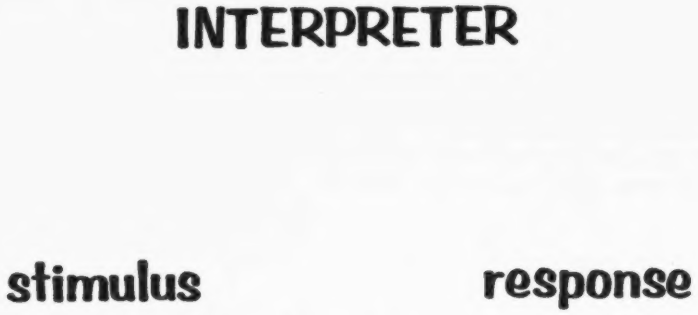


Fig. 5.1a.

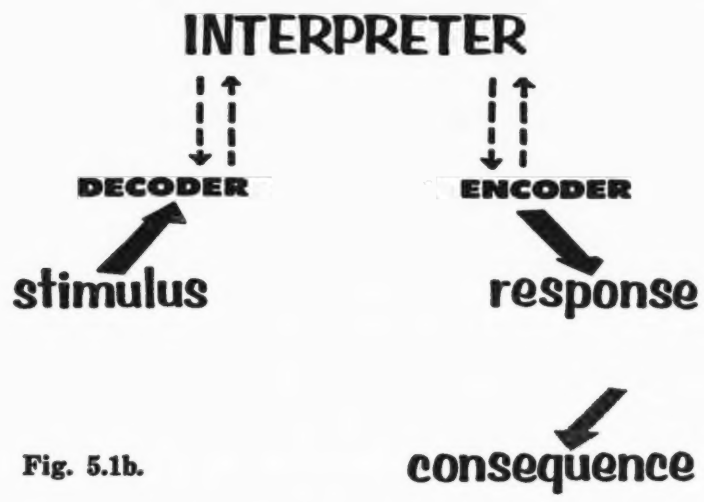


Fig. 5.1b.

the pattern of electro-chemical energy we call nervous energy. But decoding involves more than mere translation of stimuli from one form of energy to another. It involves the association of an incoming stimulus to patterns of stimulation received in the past and to other ideas and associations which are possessed by the organism.

5.14 Closely linked to decoding is the process which we call interpretation. We can postulate an interpreter mechanism for man which enables him to think, to attach meaning to sounds and sights, and to understand. Of all the ways in which man differs from lower animals, perhaps the most important is in his ability to interpret, or think about, the stimuli impinging upon him throughout his daily life. The model shows a double arrow running from interpreter to decoder: this arrow indicates not only that man decodes and passes along information from his decoding mechanism to his interpretative mechanism, but also that the interpreter itself tends to determine what is perceived and how it is perceived. What we see and hear is colored by our past experiences, our memories, and our ideas. People do not perceive the world as the "booming, buzzing confusion" of sights and sounds attributed by William James to the infant. What we see is selected for us, and colored for us by the interpretative mechanism we all carry in our heads.

5.15 After interpretation has taken place, the individual must *encode* some response. From the interpreter messages are sent to the encoding mechanisms of the larynx, the fingers, and the muscles. The second arrow is present on the encoding side of the diagram to indicate that encoding is not a simple process. Trial encoding may take place many times before the individual actually responds to a particular stimulus. As we indicated above, encoding may represent only part of the individual's response to a stimulus. Or to put it a different way, the individual may have both overt and covert responses, observable and non-observable responses.

5.2 Consequences and Rewards

5.21 After a response is produced, the individual has the opportunity to observe the *consequence* of that response. In human learning and human communication all responses have consequences for the individual. The consequence of a response is not the response itself. The response may be "running away from a poisonous snake found on a path"; the consequence of that response may be that the individual doesn't get bitten. The response may be to change an attitude toward some other individual; the consequence of that response may be to obtain a raise in pay, or a new position.

5.22 Introducing the notion of consequences means that we must also introduce the idea of reward and its relationship to human learning and communication. The observed consequences resulting from response to a communicating situation will be termed rewarding or unrewarding by the individual. If the consequence is rewarding, then the individual may be more likely to make the same response when a similar situation is presented. If the consequence is perceived as non-rewarding, the probability is that the individual will make a different response when placed in a similar situation. The concept of reward is obviously not linked to monetary or status rewards. Rewards may involve only a feeling of satisfaction with the consequences, of pleasure, or merely of conviction that it was better to have done what was done than to have done anything else.

5.23 Human beings react in many ways to similar stimuli. Yet a careful examination reveals several principles which seem to underlie human behavior in many situations. One of these notions is the *principle of least effort*, closely tied to another concept of *expected reward*. In general, we can say that individuals will respond to any situation with the least amount of effort which is required to obtain an expected reward. Thus the source may find real difficulty in getting people to take some specific action. The reason may be that individuals perceive the effort required to be greater than the reward expected from the response desired. The concepts of expected reward and effort required are integral parts of any examination of the learning process and its relationship to the process of communication.

5.3 The Model in Communication Terms

5.31 The portion of the Interpreter Model we have considered so far involves functions concerned with the receiver rather than the source of communication. In Fig. 5.1c, we notice that a source has been added to the visual. As we discussed earlier when considering the S-M-C-R Model, sources and receivers may interchange positions, or even be the same individual at the same time. Therefore we are justified in attributing the same elements of Decoder (De), Interpreter (In) and Encoder (En) to the source that we attribute to the receiver of communication.

5.4 Responses

5.41 What is shown in Fig. 5.1c is a complete communication situation involving a source producing stimuli which we can call *messages*, and a receiver who decodes those stimuli, interprets them, and encodes responses based on the stimuli received. There are, however, some terms in Fig. 5.1c which have not been explained. One way of looking on the terms *attention, meaning, understanding, acceptance, commitment* and *action*, is to say that these are possible responses of the receiver of any message.

5.42 Internal responses which are necessary to communication include attention and meaning. The source cannot expect to be successful in communication if the receiver of the message is not paying attention to the message. One response, then, which the source is desirous of obtaining on the part of the receiver is *attention* to the source and his message. The source can also not expect to be successful in communication or learning if the receiver doesn't understand what is said. Understanding is part of the process of obtaining meaning for messages. It involves not only an understanding of the meaning of words, but also of sentences and larger elements within the message. A second part of the

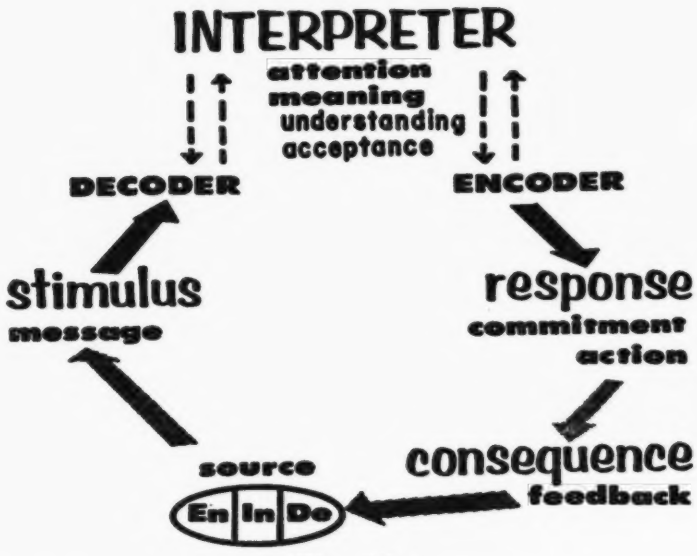


Fig. 5.1c.

meaning process is obtaining acceptance. Understanding is not enough in many cases; we also want our receivers to accept — that is, agree with — what we have to say. Obviously, gaining acceptance is not easy when receivers are initially opposed to a position. And we might say that before he can accept a message, a receiver must first attend to it and gain some meaning from it.

5.43 Internal responses by a receiver are frequently only the first steps in producing learning. The source frequently wants a receiver to act on a message in some externally visible way. At least two of the responses which we might talk about as being useful in the teaching situations with which we deal are commitments and actions. Frequently, sources want receivers to publicly commit themselves to some program. Sources also want receivers to respond by taking some action, i.e., they want them to vote, put a new farm program into operation on their own farm, or help raise money for some civic project. A receiver takes action only after internal responses, in the form of attention and acceptance, have occurred.

5.5 Feedback

5.51 The learning process, when related to the communication process, also involves *feedback*. In our model, feedback is shown by the arrow going from the consequence to the source (Fig. 5.1d). Feedback in communication can take place in several ways, and each way is accompanied by its own problems. *Direct* feedback occurs when a source is able to observe both the responses of a receiver and the consequences attending those responses. This typically occurs in the face-to-face situation where a source is talking to a receiver or a group of receivers. All of us develop ways of estimating the responses which we observe our receivers making. In the public-speaking situation, for example, the speaker learns how to estimate his audience's response through noticing their facial expressions, bodily movements, questions, etc. These estimates are seldom perfect; the source may be entirely misled. For example, the source may decide that an individual with his eyes closed isn't paying attention, whereas this receiver might actually have closed his eyes in order to concentrate better on the message. Nevertheless, speakers do manage to make predictions about their audiences and to modify their opinions about the audience or change their messages to the audience through the use of feedback.

5.52 Indirect feedback presents an entirely different type of problem. In this situation, the source does not have direct contact with his receivers. The source may be a writer, who will never see his readers. He may be a scientist, whose messages will be translated by an editor into a bulletin to be read by farmers, or the editor of that bulletin, who like the scientist, will never see the readers. At the present time, we cannot suggest methods of obtaining indirect feedback which approach in reliability the direct method of an experienced speaker observing his audience. Nevertheless, here too the source must obtain feedback in order to improve his future messages. Some suggested solutions include making surveys of the audience, using electronic instruments on television sets, and sending out questionnaires. All of these methods have their values and their adherents, but none provides completely satisfactory answers. None offers a continuing feedback which is immediately available to the source. At best, they may provide partial information to assist in the preparation of future messages.

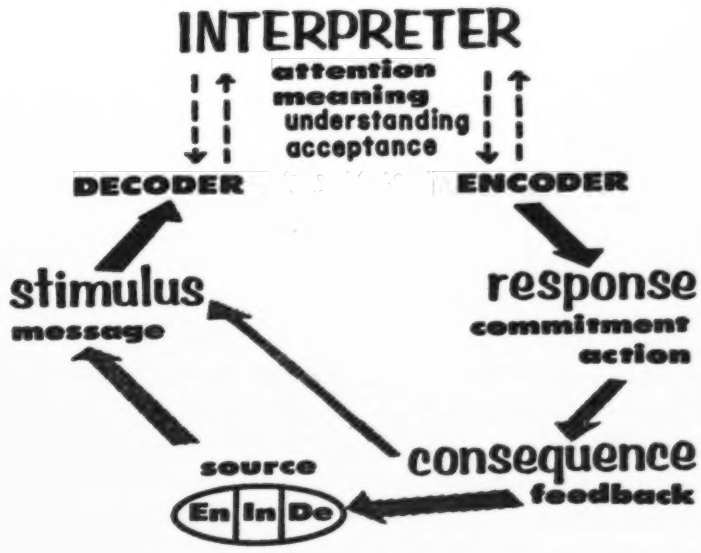


Fig. 5.1d.

5.53 One other addition to the model in Fig. 5.1d deserves special attention. This, the long diagonal arrow leading from consequence to stimulus, represents the feedback direct to the individual (the interpreter). To the extent that an individual remains aware of his own responses and the consequences of these, he can adjust or correct his subsequent actions. A good example of this is the person talking who mispronounces a word, hears himself, and immediately repeats the word correctly.

5.54 The Interpreter Model, as we have visualized it so far, seems to indicate that feedback is merely the source's observation of receiver responses. The discussion we have just made of this arrow indicates that the problem is never as simple as might be indicated by a visual model. Feedback problems are always with us, and are never easily solved. But if the source is to be effective, he must attempt to obtain and interpret feedback from his receivers in order to continue to produce effective messages.

5.6 Habit

5.61 One more factor is important to both learning and communication. In our visual model, (Fig. 5.1e), the jagged arrow between the encoder and the decoder represents the *strength of habit.* In time we acquire habits, or responses made without interpretation. In the morning, when we see a pair of shoes on the floor, or a lathered face in the mirror, we no longer think about the actions we perform as we stroke the lather off the face, or stand up from the task of tieing our shoes. We perform tasks similar to these throughout our daily lives, and no longer interpret the stimuli leading to our responses. These are *habits.*

5.62 How are habits formed? One way to approach the question is in terms of reward and consequences. When the child is first faced with the shoe-tieing situation, the parents praise the child every time the task is accomplished correctly. After a number of times, the child's parents may stop physical praise on the grounds that the child now knows how to perform the task. But by this time, the child has reward mechanisms built into its own system. Now, having an untied shoe is uncomfortable, and the child still continues to tie his shoes. After a period of time, the physical motions required to accomplish the task become mechanical. The child no longer has to think about the various steps necessary to continue tieing shoes correctly.

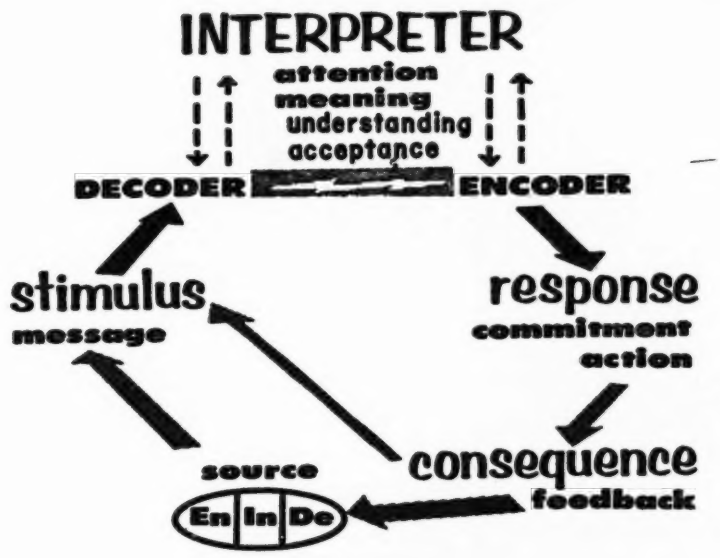


Fig. 5.1e. The Interpreter Model.

5.63 Perhaps most habits are desirable. We would not want to have to think about tieing our shoes every morning. But many times we are faced with the situation where we as sources must attempt to obtain responses requiring an individual to break habits. We have a new system for rotating crops. Farmers in our state have been using another system for so long that the use has become habitual. What this model suggests is that in order to break the habit arrow, the source must find ways of making the receivers interpret their actions. Only through interpretation can individuals eliminate old responses in order to prepare for new responses.

5.64 Anyone who has attempted to break a smoking habit established over years will quickly realize just how difficult it really is to break a habit. How then can a communicator hope to break the habit arrow, to obtain interpretation? Many ideas could be suggested. In this chapter, we can mention only a few. Existing habits can be used to eliminate undesirable habits. To have the farmer change his farming methods, an appeal to habits of thrift might be used. Existing desirable habits might be strengthened, with a consequent weakening of undesirable habits. Changes not immediately related to the habit under attack might be suggested, as a way of preparing a receiver for the eventual breaking of a habit. Suggestions of ways to reduce effort by changing habits may help, since receivers are probably motivated toward reduction of the effort required for any task. New rewards might be suggested, to an extent that a receiver would perceive increased reward through change of habits.

5.65 None of these methods will work for all cases, and combinations of several may often have to be used. Yet, we can certainly say

that one of the most difficult and important tasks in communication is that of getting receivers to unlearn old habits, so that new patterns of interpretation may be set up.

5.66 In the past few pages, we have examined the Interpreter Model. What we have said represents only one way of looking at this model. The model is rich in ideas and content. Yet it is still only one visualization of the communication process: one which attempts to link communication and learning. The model shows that there is little difference between these two processes. As a concluding point, and as one other way of linking communication and learning, we can perhaps observe that communication sources are always interested in:

OBTAINING OLD RESPONSES TO NEW STIMULI

or

OBTAINING NEW RESPONSES TO OLD STIMULI

When either of these objectives is obtained, learning has also taken place.

6. Communication Effects

prepared by J. Stacy Adams

6.1 Introduction

6.11 When we consider the field of communication within the context of social science, we may divide the field into two main areas: interpersonal and mass communication. We might, in addition, consider intrapersonal communication, that is, man to himself, and machine communication, either machine to man or man to machine. The latter two divisions, however, are more in the province of the human engineer.

6.12 The two divisions of communication, interpersonal and mass, have not, on the whole, been unified, although Katz and Lazarsfeld, for example, have attempted to effect some kind of rapprochement. The existing theories of communication apply only to certain limited aspects of communication, or to special communication situations.

6.13 In the absence of one or more unifying theories of communication, it is useful to talk about communication in terms of one of the models available. The model that seems the most useful here is based on that of Shannon and Weaver *(3.52-3.59). Its six parts include a source,* an encoding device, a channel, a message, a decoding device, and a receiver.

6.14 In discussing interpersonal and mass communication processes, we shall make use of six headings corresponding to the six components of this model. Since we cannot be complete in reporting empirical findings, we have selected some representative studies in which the findings are comparatively unambiguous. Although a given study may be discussed under one of the six headings, it is both possible and likely that the same findings could have been discussed under one or more other headings.

6.15 Research dealing with communication processes necessarily touches upon several aspects of the communication process or several of the steps in the model. Emphasis, however, is often on only one of these. Throughout we shall emphasize experimental as opposed to field studies, our rationale for this being that through experimental studies, we obtain a better understanding of the operation of the variables than we would in field studies. This is not to say, of course, that field studies are of no value; quite to the contrary, many of the experimental studies that we shall report, or the hypotheses which they set out to test, were based on the findings from field studies or field observations.

6.2 Source

6.21 Considering its importance, the source has received relatively little research attention. Such studies as have been done, however, are provocative and extremely important in understanding the process of communication. Early studies dealt with the well-known prestige or prestige-suggestion phenomenon.

6.22 Asch and his associates did a considerable amount of research on this phenomenon. Their general findings, and those of their predecessors, were that when a communication was attributed to a prestigeful source, there were opinion or attitude changes in the direction of the prestigeful source's position, in contrast to the case where the communication was attributed to a non-prestigeful source. However, Asch and Lewis showed that it was not prestige that was the critical variable. Rather, they pointed out that when a message incompatible with the recipient's opinion is attributed to a source, the message content is itself reinterpreted so that there is congruity between the message and its source. Thus, if a New Deal Democrat was given a message of fascist tinge to read, and this message was attributed to Franklin D. Roosevelt, the person was likely to reinterpret the message content so that it was congruous with the subject's image of FDR.

6.23 This finding is of considerable interest for its significance to communication

theory, and also in that it anticipates the theoretical developments of Osgood's theory of congruity and of Festinger's theory of cognitive dissonance, both of which postulate that subjects will tend to establish some sort of equilibrium between their perceptions or cognitions. In the illustration we gave, the problem for the receiver would be to establish equilibrium between the message content or the cognition of the message's content, and his cognitions about FDR.

What we have said, of course, applies only when an incompatible message is attributed to a source, and we see that it is not so much the positive prestige of the source that "causes" the receiver to change his opinion, but rather that the receiver changes his perception of the message so that it is consonant with the perception or cognition he has of the source. In the case of compatible messages, prestige does operate, although this factor is more commonly referred to as the credibility of the source.

6.24 Osgood's congruity theory and his work with the semantic differential is closely related to the findings of Asch and his students, reported above. Osgood is much more specific. He considers the effects of linking a source of positive or negative valence (ability or inability to combine) to a concept of positive or negative valence by a positive or negative assertion. Considering, then, the valence of source, concept and assertion, where concept for present purposes may be taken as the message or communication, Osgood is able to make quite accurate predictions about changes either in the attitude of the recipient toward the source or in the concept, or both. Theoretically, his position is, as was implied by Asch and Lewis, that there is a tendency for the recipient to move towards congruity, to establish equilibrium between his perception or cognition about the source and concept.

6.25 We might illustrate this: For example, if a highly valued source is linked by a positive assertion to a highly negative concept, there will be a tendency for the individual's ratings or judgments of both the concept and source to change somewhat. To take a specific example: If Eisenhower, a highly-valued source, let us assume, stated that he basically approved (a positive assertion) of the action of Soviet Russia in Hungary, we would find that Eisenhower would decrease in positive valence and that the Soviet action in Hungary would slightly increase in valence; or to put it another way, the Soviet action would become less negative.

6.26 This, of course, is a somewhat gross example to illustrate what would occur and Osgood, of course, is able to make much finer predictions than this illustration would lead one to think. He is able, for example, to predict the amount of change that would take place in either concept or source, from knowing the particular valence of source and concept, and from knowledge of the sign of the assertion linking them.

6.27 He theorizes that the more polar a concept or source is, compared to the valence of the other element, source or concept, the more change will occur in the attitude towards the lesser valent of the two. Thus, for example, if Adlai Stevenson had been reported to say, "I like Joe McCarthy," and if we assume that the valence attached to Stevenson is plus three and that to Joe McCarthy minus two, we would find that there would be more change in the attitude towards McCarthy than towards Stevenson, because Stevenson has a more polar or more extreme value associated with him. Thus, there would be more favorable change towards McCarthy than there would be unfavorable change towards Stevenson.

6.28 Other studies relating to the source or communicator have been done by the group under the directorship of Carl Hovland at Yale. In a carefully designed experiment Hovland and Weiss showed that when source credibility was varied, opinion change was directly related to the credibility of the source. Thus, when communications on the development of atomic submarines were attributed, on the one hand, to Oppenheimer, and on the other hand, to Pravda, it was found that 36 per cent net opinion change occurred when the communication was attributed to Oppenheimer, and zero net opinion change when it was attributed to Pravda.

6.29 A further study by Kelman and Hovland dealt with communications on the topic of leniency in the treatment of juvenile delinquency. The communications were attributed either to a judge, a man on the street having essentially neutral credibility, and to a shady former delinquent. The communications attributed to each of these were identical in advocating leniency toward juvenile delinquents. Significantly higher leniency scores were found in response to the communication attributed to the judge. Furthermore, these scores were significantly related to the perceived trustworthiness and expertness of the sources. The judge was perceived as extremely trustworthy and expert in the matter of juvenile delinquency, whereas the shady character who was formerly a delinquent was perceived as not only being untrustworthy and not expert, but also as being very definitely biased.

6.2.10 A third study by the Yale group, that by Hovland and Mandell, found similar results with respect to the perceived fairness of a communication, but, on the other hand, did not find significant differences in the effect of a communication attributed to different sources. In this case the communications were taped talks on the subject of the devaluation of the currency. Again, the talks were identical. One was attributed to an importer who presumably would be biased on the subject, and to an economist, presumably a trustworthy, expert, non-suspicious person. It was found that the talk attributed to the importer did not produce significantly less attitude change than the talk attributed to the economist. However, the importer was perceived and judged to be less fair than the economist. Thus, though on the whole we find that attitude and opinion change is directly related to the credibility of the source, this particular study suggests that this is not invariably the case.

6.2.11 A different kind of study is that by Merton, reporting his analysis of Kate Smith's war bond drive on the radio during the war. It was established that Kate Smith was directly responsible for the sale of many war bonds, and this ability was attributed by Merton to the extreme sincerity which Miss Smith imparted to her audience. Furthermore, because of the hardship of the long radio broadcast, the audience preceived that she was making a considerable personal sacrifice. This sacrifice, perhaps, was perceived as being equivalent, to some extent, with the sacrifice being made by members of our armed forces, and Merton suggests that this put pressure on members of the audience to perform a similar sacrifice. The situation was, so to speak, as if the sacrifice triangle had to be closed (see *closure*, 7.9.11).

6.3 Encoding

6.31 The second step in the model is that of encoding. Problems of encoding have not traditionally been associated with interpersonal and mass communication. Several psychologists have studied problems of language learning, which, fundamentally, are problems of encoding. Mowrer and Osgood have both developed rather similar theories of language learning, making use basically of a conditioning paradigm. They have been careful, however, not to make the simple, but rather serious, mistake made earlier by psychologists such as Watson, who were primarily interested in classical conditioning.

6.32 They have quite rightly pointed out that saying "I am eating an apple," for example, is different from eating an apple. Both Mowrer and Osgood get around this problem by postulating a component of the response, in this case to the "real" apple. It is by means of this partial or component response that conditioning — verbal conditioning — becomes possible. B. F. Skinner has also addressed himself to the question of language learning, and has made substantial contributions through his functional analyses of verbal behavior. His concepts of the reciprocal character of reinforcement in language learning and of the "verbal community" are particularly useful.

6.33 Recent interesting contributions to the psychology of encoding have been made by Jerome Bruner, Roger Brown, and their associates. The realm of behavior to which they have addressed themselves has been referred to as "categorizing behavior." Brown, perhaps, has been most explicit about categorizing behavior as it applies to communication. Cognitively speaking, objects and events are categorized — that is, they are placed into categories. A category is a class; membership in the class is determined by whether or not the objects and events have particular attributes, or combinations of attributes in common. An attribute, in turn, may have different degrees of criteriality. An attribute with high criteriality can be more easily categorized than one with low criteriality. For example, smell has a fairly high criteriality when placing objects into the category "onion"; shape, on the other hand, has much lower criteriality, since many other vegetables have shapes similar to that of onions.

6.34 It is evident that in communication it becomes extremely important to know something about categories, their defining attributes, and the criteriality of the attributes. For the purpose of transmitting a message to a particular receiver, it is important when encoding the message that the attributes used in categorizing events or objects have high criteriality.

6.35 It is necessary, however, that the attributes used also have more than merely a high objective criteriality. It is necessary that they have a high criteriality for the receiver. The fact that, objectively, an event or object can be categorized by the use of attributes of high objective criteriality does not imply that a person classifying or categorizing the object or event would assign the same criteriality to the attribute. For example, a person whose smell was particularly insensitive would not give to the smell of an onion a high criteriality. For this person, shape, texture, weight may be more highly criterial. This is

the type of problem that we run into when we converse with someone who speaks another tongue, whether it be a foreign language or a technical language.

6.36 Information theory, from which our six-part model is adapted, has been especially concerned with problems of encoding. It has addressed itself particularly to problems of devising optimal codes. Information theorists have attempted to devise not only economical communication systems, but also efficient communication systems and codes. One of the things which they have pointed out that is of particular interest is that when encoding a message, it seems necessary to incorporate in it a certain amount of redundancy. English, for example, is approximately 50 to 70 per cent redundant. It is not that words or phrases are repeated, but rather that the same idea or relationship is expressed in more than one way. The structure of language is such that if we had perfect transmitting media and perfect receivers we would need to transmit much less than we now do.

6.37 If (to choose an example based in part on formal letter relationships in writing) we were to ask a person to play a guessing game of the following type, it would be found that his performance would be far better than one might expect him to do by chance. The game is as follows: One asks the person to guess at a sentence which the speaker has in mind. The person is to guess successively at each letter, beginning with the first letter of the first word in the sentence. On the initial letter he will not do much better than chance. Given the first letter, however, he will do rather better than chance on the second, and much much better on the third, and, if it is more than a three-letter word, he will guess the fourth or fifth almost without error. As the game progresses, he is now able not only to guess letters with increasing accuracy, but whole words.

6.38 This clearly illustrates the built-in redundancy of language, for were it not redundant, the performance of the person would not be much better than chance expectancy. A well-known example of redundancy in written English is that of the *u* which almost invariably follows the *q*, except in the case of a few foreign words like the British protectorate Qatar. Once we know that *q* has occurred, one knows with almost 100 per cent certainty that *u* will follow. A structural example that applies to both written and spoken English is the indication of plurals by both verb agreement and addition of "s": in "boys are" both the "s" and the "are" mean plurality.

With or without realizing it, all sources use redundancy to increase communication effectiveness. Teachers, for example, use repetition of a lesson over time, reviews of exercises, reviews of lectures, and examinations.

6.39 Psychology, in particular, has contributed much to other aspects of encoding. Psychologists have paid special attention to production processes, which are, in fact, encoding processes. Thus, for example, the study of speech production, which has been studied in considerable detail, is in fact the study of encoding processes. Linguists and anthropologists have devoted much attention to the study of linguistic encoding, phonemic and morphemic encoding, for example. Some anthropologists have devoted lifetimes to the study of kinship, which in some aspects is the study of how members of the society are coded.

6.3.10 Some psychologists have been especially interested in the dimensionalization, or the coding, of auditory and visual inputs. In some sense, the study of sensory psychology, particularly as regards audition and vision, is concerned with this. When J. J. Gibson speaks of psychophysical correspondence, when he speaks of texture and other gradients, he is really speaking about the encoding of visual inputs. His elaborate study of textural density gradients is, in fact, a study of a particular aspect of the coding of the visual world.

6.3.11 In another area of sensory psychology, Geldard at the University of Virginia has in recent years been interested in the encoding of vibratory stimuli. The problem to which he addressed himself was that of finding a sensory modality that could be used in addition to the ones which we most ordinarily use, vision and audition. In some situations both of these modalities are at least temporarily impaired, for example, under some conditions of high speed flight. Having discovered that man had a vibratory modality which would be put to use when either vision or audition or both were impaired, his partial solution to the problem was that of a belt of seven vibrators worn around the thorax or abdomen. These vibrators would be made to vibrate for certain durations, in certain combinations, and in certain orders. By intensive study he was able to arrive, at least tentatively, at some optimal coding for vibratory inputs.

6.3.12 Though this may strike one as a rather peculiar communication system, it is nevertheless a communication system, and problems of encoding are obviously extremely important. Their importance is perhaps more obvious here

than in the case of other modalities, but only because it is a rather new modality. In the case of the other modalities, we probably never really are forced to consider the importance of encoding in our daily commerce with the environment.

6.4 Channel

6.41 A good deal of research has been done with respect to the channels[1] of communication. We shall divide this research grossly into two parts. We shall first consider the research dealing with the channels *per se*, and then go on to consider the research having to do with the patterning of channels. Until recently, field research has taken precedence over experimental research as regards the channels of communication. Early experimental studies dealt, for example, with the relative effectiveness of oral versus printed communications. The work of Wilke and of Knower, for example, is in the experimental tradition. Generally, it was found that face to face communication was more effective than indirect communication.

6.42 More recently, an experimental approach has been made to the effectiveness of television and television kinescopes. The research here has been primarily action oriented; that is, the researchers have attempted to solve some rather practical problems, the main one being that of finding economical and efficient means of teaching. The armed forces have done, and sponsored, much research on these lines. Their findings as well as those of others have been that television and kinescopes are just about as effective as face to face lectures and class room work.

6.43 Other, indeed most, comparative studies of channels of communication have been of the field variety. Perhaps the best known of these is that of Katz and Lazarsfeld. In *The People's Choice*, they reported on the relative importance of different mass media as these influenced voting. They found in this instance that radio was judged as "most important" by greater percentages of subjects than were newspapers.

6.44 In recent years television has, of course, been the focus of a great deal of research. We shall cite here two studies of particular interest. The first is an imaginative, sophisticated field study of the effects of television on children. From theoretical considerations, Eleanor Maccoby was interested in the vicarious satisfaction which children get through fantasy, in this case via television. Her provocative finding was that in upper-middle-class homes children who were frustrated in home life watched TV most. In the upper-lower class there was no relation between TV viewing and frustration in the home. She explained this difference in the upper-middle and upper-lower class by the fact that in the upper-lower class television viewing is a dominant activity, whereas in the upper-middle class it is not. Hence, in absence of frustration the child is drawn away from television in the upper-middle class. In the upper-lower class, on the other hand, where television is a dominant home activity, children view television whether or not they are frustrated.

6.45 A study in a somewhat different vein was conducted by William Belson in greater London. He was specifically interested in the effects of television on certain cultural functions, and more generally, upon other behaviors. Contrary to the popular belief, television does not necessarily decrease all other leisure-time behaviors; for example, it was found that associated with television was increased attendance at certain cultural functions, like museum-going. The general finding, however, is that other leisure activities are generally curtailed when television is acquired. This decrease is at first rather sharp, but there is partial recuperation after a period of approximately one year. However, other leisure activities do not return to their pre-television level until after four to six years. Of all other leisure activities, movie-going was most affected by television, and recuperation from the effects of television ownership were slowest. Despite the effects of television on other activities, it must be noted that the losses incurred by other activities are apparently only temporary. Similar findings have been reported from a series of studies conducted in New Brunswick, New Jersey.

6.46 By the patterning of channels of communication, we refer to the links that exist between points in a communication network. Several studies have focused upon the problems of patterning, and the relative efficiency of communication using different patterns. Some of these studies have been experimental; others have been field or observational studies. A study by Heise and Miller made use of three-person communication networks, in which the connections between the subjects were experimentally varied. Three of the patterns used by these authors are illustrated in Fig. 6.1.

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[1]Ed. note: Adams uses a somewhat less specific interpretation of "channel" then that developed in the S-M-C-R model. Also, "encoding" and "decoding" differ from the definitions supplied in discussion of the Interpreter Model.

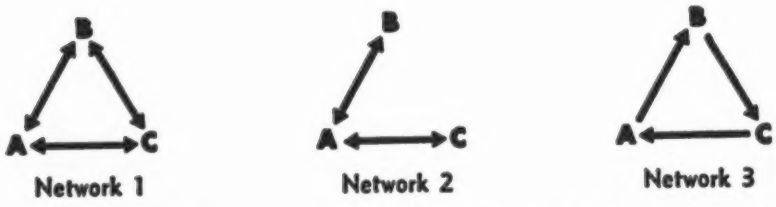


Fig. 6.1. Communication networks used by Heise and Miller. (Adapted from G. A. Heise and G. A. Miller. "Problem solving by small groups using various communication nets." *J. Abnorm. Soc. Psychol.*, 1951, 46, 327-335.)

6.47 In the first pattern or network, each individual is connected — that is, has a channel of communication — with the immediately adjacent person, and furthermore, adjacent pairs may talk back and forth to one another. In the second pattern individuals A and B and individuals A and C have bilateral communication, while B and C cannot communicate directly with one another. In the third pattern, the communication exists between adjacent pairs, but the flow of communication is only in one direction. Thus A can communicate directly with B, but B not with A; B can communicate directly with C, but C not with B, and so on.

6.48 Heise and Miller had subjects in each of these communication patterns solve three types of problems. One problem involved reassembling lists of words. The second problem entailed the construction of sentences. Finally, the third problem demanded solution of anagrams. The findings were that in the problem of reassembling lists of words Network 1 was most efficient. Network 2 was moderately efficient, and Network 3 was least efficient. In the sentence construction problem, Network 2 was most efficient, Network 1 next, and Network 3 least efficient. In the anagram problem the three patterns were equally efficient in solving the problem. The different relative efficiencies of the nets in different problem situations is of some interest.

6.49 In comparing the results in the problem of reassembling lists of words with that in the sentence construction problem, we see that, whereas Network 2 was only moderately efficient in the reassembly of words, it was most efficient in sentence construction. Heise and Miller explain this difference on the basis of the fact that the sentence construction problem was a good deal more complex, and that in the case of such a complex problem, having a leader is more important than in the other problem. By leadership here, of course, they refer to individual A in pattern two who, compared to the other patterns, is in a central position. Flow of information from B and C is to A and to A only. When noise was introduced into the communication channels between the individuals, the differences found between the patterns were accentuated in the case of the first two problems. However, introduction of noise in the channel made no difference on the solution of the anagrams.

6.4.10 The studies of Bavelas and Leavitt have shown the effects of patterns of communication in five-man groups. We may cite some of the results of Leavitt as typical. Four of the patterns used by him are shown in Fig. 6.2.

6.4.11 In the first pattern, the circle, all adjacent individuals are bilaterally interconnected. In the chain individuals are interconnected as in the circle except that two have no direct communication channel between them. In the Y, or fork as it has also been called, one individual has direct communication channels with three others; the other individuals have a communication channel with only one other person in the group. In the wheel, finally, one central individual has communication channels with all four other members; these four other members, however, have no direct connections between them.

6.4.12 The problem which the individuals had to solve was to find, as rapidly as possible, the one symbol which all five members had in common. Each member had five out of a possible set of six. The individuals were seated around a table, separated by partitions in which there were slots that permitted the exchange of notes. The arrangement of the slots were manipulated so as to give the channel patterns shown in Fig. 6.2.

6.4.13 In terms of errors, the circle had the most, the chain and the wheel had approximately the same number of errors, and the Y had the least number of errors. Despite the relative inefficiency of the circle, the members of this communication network were most satisfied and those in the wheel least satisfied. When dissatisfaction was broken down by the relative centrality and peripherality of the individuals in the

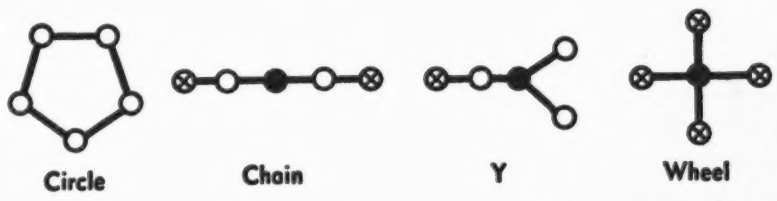


Fig. 6.2. Communication network used by Leavitt. (Adapted from Leavitt, H. J. "Some effects of certain communication patterns upon group performance." *J. Abnorm. Soc. Psychol.*, 1951, 46, 38-50.)

various nets, it was found that the most peripheral individuals, as indicated in Fig. 6.2 by crosses, were least satisfied. By contrast, the most central individuals, those shown in solid color in the figure, were most satisfied. The dissatisfaction or satisfaction corresponded closely to the perceived leadership patterns. When, at the end of the experiment, the subjects were asked whether they perceived that their particular group had a leader, very definite leadership patterns were reported by the subjects in the wheel, Y, and chain. In the circle, subjects did not perceive a leadership pattern emerging. In some sense, all individuals were equally central in the circle.

6.4.14 A quite different type of study than the ones previously reported is that done by Katz and Lazarsfeld and subsequently by Mensel and Katz. These workers were interested in the question of the influence of mass media upon the individual. In earlier studies they had found that the mass media, newspapers and radio particularly, seemed to have little direct effect upon voting behavior. However, there was substantial evidence that interpersonal influence was considerable. They hypothesized, therefore, that information or communication from the media flowed through one person to another.

6.4.15 More specifically, they hypothesized that information from the media flowed through an opinion leader, who was exposed to the media, on to another person or persons. They referred to this as the "two-step flow hypothesis." In their book, Katz and Lazarsfeld partially substantiated this hypothesis when they showed that persons who were particularly likely to be exposed to the mass media were also particularly likely to be asked advice. They did not, however, demonstrate the necessary condition for support of the hypothesis, namely, that a particular piece of information flowed from the media to the opinion leader to the person. All they were able to demonstrate was that, on the one hand, opinion leaders were more exposed to the media than non-opinion leaders, and, on the other hand, that information from opinion leaders flowed to non-opinion leaders.

6.4.16 Some researchers have questioned the two-step flow hypothesis and thought it more likely that the flow was an n-step flow. In a study of the use of new drugs by doctors in the community, Mensel and Katz presented evidence that the n-step flow hypothesis was probably more tenable.

6.4.17 In an unpublished study entailing the intensive interviewing of farmers and people in rural communities, Adams and Horvitz also found that the n-step flow hypothesis was probably sounder than the two-step flow hypothesis. In this unpublished study it was clear that farmers' adoption of fertilizer usage, as well as the adoption of other recommended farm practices, were not subject so much to a direct influence by the mass media nor to a two-step influence from media to other farmers, but, rather, were subject to a fairly long chain of influences. Thus, for example, a farmer who had adopted crop irrigation procedures was not influenced directly by something he had read or heard in the mass media, but was influenced by a neighboring farmer. This neighboring farmer was, in turn, not influenced by the media, but by both agricultural agents and a farm machinery dealer, and it was discovered that both of these had to a certain extent been influenced by some of the media. In some cases it was possible to trace back six or seven steps in the influence process.

6.5 The Message

6.51 In recent years an impressive amount of research has been conducted on the message or communication itself. Much of this research has been done by the Yale group. Two aspects of the research on the message are particularly important: that concerned with the nature of the appeals made in the communication and that dealing with the problem of the order of presentation of the arguments within the communication.

6.52 In an early study Hartmann determined the effects of emotional versus rational appeals. The study was specifically concerned with the effects of propagandistic political leaflets in city wards. In some wards emotional leaflets were passed out, in other wards leaflets with essentially rational arguments were used, and in control wards none were passed out. The leaflets, whether emotional or rational in appeal, were in each case designed to increase the Socialist party vote. The three groupings of wards were fairly well matched so that observed differences in the number of people voting for the Socialist party could be compared with some confidence. Hartmann's results showed that the emotional appeal was approximately 50 percent more effective in getting out the Socialist party vote. Other studies on the relative effectiveness of emotional versus rational appeals have, however, found no difference.

6.53 A number of ingenious studies on the effectiveness of fear appeals have been con-

ducted by Carl Hovland and his associates. The better known of these is the study of Janis and Feshback in which strong, moderate, and minimal fear-appeal versions of a communication on dental hygiene were prepared. The communications differed fundamentally in the number and type of fear-arousing appeals which they contained. In the strong fear-appeal communication, for example, the harmful, painful effects of improper dental hygiene were stressed, whereas in the minimal appeal version of the communication, these were not alluded to. The results clearly showed that of the three versions of the communication the minimal appeal version was most effective in leading to both acceptance of the communication and resistance to a subsequent counter-communication.

6.54 In their theoretical discussion of their findings, the authors adopt what they call a "defensive avoidance" explanation of the results. They hypothesized that when fear is aroused in the recipient of a communication, and this fear is not adequately relieved by reassurances in the communication, the recipient will be led to ignore the importance of the threat. Furthermore, the recipient of such communications will tend to avoid exposure to any stimuli which were associated with the fear-arousing communication. Presumably, in the particular study done by Janis and Feshback, anything having to do with dental hygiene (e.g., toothbrushes, toothpaste, teeth, mouth, etc.) had, because of their association with the fear-arousing communication, some anxiety-provoking attributes. Hence the recipients of the communication would have tended to avoid these.

6.55 The evidence in support of this explanation of the results comes from the answers which subjects gave to questions asked of them following their exposure to a counter-communication. Among the subjects who disagreed with the counter-communication, those who had received the minimal fear-appeal were likely to mention the original dental hygiene communication as an authoritative source and to mention its arguments in supporting their disagreement with the counter-communication. These references were much less evident among those subjects who received the counter-communication and who had previously received the moderate or strong fear-appeal arousal, thus suggesting that these subjects were avoiding recall of the content of the original fear-arousing communication.

6.56 A subsequent study by Janis and Milholland showed that there were no differences in the mean amount of information acquired by the experimental subjects in strong or minimal fear appeal communications. However, although there was equal recall, in terms of number of items recalled, in the minimal and strong fear groups, the nature of the items recalled in the two groups differed sharply. When the items recalled were classified as to causes of the threat (e.g., the effects of food between the teeth and the formation of acids in the mouth) and the unfavorable consequences of the threat (going to the dentist, pains from decaying teeth, inflamed gums, and so on), it was found that the causes of the threat were better recalled in the minimal fear appeal group. Conversely, unfavorable consequences of the threat were better recalled in the strong fear-appeal group.

6.57 These findings are partly consonant with the defensive-avoidance hypothesis mentioned earlier, for it is clear that in the case of the strong fear-appeal group there was selective forgetting of the causes of tooth decay, whereas the fears appealed to in the communication were relatively well recalled. We may thus tentatively conclude that strong fear appeals have undesirable effects in that the individual, being unable to recall the causes of the threat, will be less prepared to meet it.

6.58 The question of the relative effectiveness of different orders of presentation has also received attention. Early research was concentrated on problems of the relative effectiveness of recency versus primacy. In general, it was held that primacy was superior. This finding was reported by Lund in 1925. In repeating the Lund experiment, Hovland and Mandell found primacy in one and recency in two of their experimental groups. In further replications of the experiments recency effects were dominant. Playing variations on a theme, Hovland, Campbell, and Brock studied the effect of a subject's making a public commitment after exposure to a communication. They found that if, after exposure to one side of an issue, the subjects made a public commitment of their personal opinion, the effectiveness of subsequent exposure to the other side of the issue was considerably reduced. In this case, then, primacy is dominant, but apparently only when commitment to one's position follows exposure to the initial communication.

6.59 In further studies of the effects of primacy, Luchins conducted an experiment in which a person was described both as introvertive and extrovertive. Some subjects received the communication in the order introvertive-extrovertive, others in the order extrovertive-introvertive. Control subjects received descriptions of the

person either as introvertive or as extrovertive. Luchins found that when contradictory information of this type was presented in a single communication, the information coming first had the advantage: Thus, when the person described in the communication was first described as introvertive, then as extrovertive, the introvertive dimension predominated. This finding is somewhat reminiscent of Asch's warm-cold experiment.

6.5.10 In an ingenious study of primacy effects based upon Hullian learning theory, McGuire found that placing desirable communications first and following them by a less desirable communication produces more opinion change than the reverse order. McGuire assumed that for opinion change to take place, it was necessary that the subject make the preliminary responses of attending to the message, understanding its contents, and accepting the conclusions advocated in it. He then goes on to assume that a communication which is essentially in agreement with the subject's opinion will reward or reinforce the attention responses, the comprehension of the message, and the acceptance of the conclusions of the communication. Conversely, if the message is essentially at variance with the opinion of the subject, the responses of attending, comprehending, and accepting the content of the communication will be punished.

6.5.11 He deduces from this that if a series of messages are presented to the subject, and that some of these are in accord with the subject's opinion while others are not, more opinion change will be produced in the case where those in accord with the opinion of the subject are presented first than if in the reverse order. This results from the fact that the subject will be rewarded for attending, accepting, comprehending the message and will tend to do so on subsequent communications. If, on the other hand, the reverse order is presented, the subject, being punished for attending, comprehending, and accepting the message, will develop avoidance tendencies upon exposure to subsequent messages.

6.6 Decoding

6.61 Decoding problems are largely the obverse of the coding problems referred to earlier. Categorizing behavior, information theory, language learning, perception of speech, audition, visual perception, vision, are all relevant to the decoding problem.

6.62 Although on the face of it the study of categorizing behavior has special relevance for a study of encoding processes, it is clear that it is equally relevant when we are concerned with decoding. The study of categorizing behavior facilitates answers to such questions as: What particular attributes will the recipients of a communication attend to and use in categorizing the events transmitted? If, in transmitting information about a particular event, we have made use of certain criterial attributes, will the subject make use of these to the same extent and in the same manner as the communicator? To some extent this problem is one of determining whether attributes have the same criteriality for both communicator and recipient. If the criteriality of the two are quite disparate, what kind of "communication" will we have? How much redundancy must be introduced into a message in order to insure that the recipient will perform the same categorizing judgment as the communicator?

6.63 Information theory is similarly concerned with problems of redundancy, but more generally it is more concerned with the question of how much information can be decoded under given conditions. These conditions would specify the amount of noise in the channel and the amount of information initially put in, including the redundancy built into the message. By giving us means of computing how much information has been transmitted to a recipient, information theory permits us to make inferences about the decoding processes of the recipient, assuming of course that the inputs are known, that the signal-to-noise ratio is known, and that relevant other conditions are known.

6.64 In an intriguing analysis of a large number of studies, primarily psycho-physical studies, Miller has shown that the amount of information that an individual human is able to handle is limited, and that the maximum is apparently seven "bits" (an information unit developed and defined by Shannon). This appears to hold for a large number of sensory modalities, vision, audition, olfaction, and so on. He has also shown, however, that if the units of information are changed, so that the individual is able to group events in a meaningful fashion, the amount of information that can be handled by the individual is somewhat larger. To illustrate, the individual can handle more information if he can treat the word "chair" as one entity than if he were responding discretely to the elements of the word, that is, the letters C H A I R. Miller has referred to this as "chunking" and has related it to the research literature on the span of apprehension.

6.65 As in the case of encoding, studies of language learning give us leverage into decod-

ing processes. It helps us understand what the learner is responding to, what stimulus dimensions of the communication he is responding to, and what situational variables of the communication he is responding to, as he learns a new language, or, for that matter, his own language. The whole literature on discrimination learning and verbal reinforcement is particularly relevant here, as are studies of bilingualism. The study of categorizing behavior and of language learning are close to one another, as Roger Brown has made apparent.

6.66 Finally, we may note that studies of audition, the perception of speech and of vision, and visual perception are relevant to decoding. What limits are imposed upon "communication" by the auditory apparatus of the recipient? What are the effects of various masking tones on communication? What are tolerable signal-to-noise ratios in a communication system? Answers to these questions and others have been studied parametrically by Miller and his associates, as well as by other researchers. Answers to problems of decoding visual communications have been provided by a large number of researchers.

6.67 On the whole, though, as is true for most of the research that is relevant to encoding and decoding, the research has not been conducted with a strict orientation to communication. Atneave, for example, has theorized on how much information is provided by the contours and angles of a figure. Others have been concerned with how much information can be provided in matrices of given dimensions, or in how much of a visual stimulus can be deleted without impeding recognition of the stimulus. The latter studies are to some extent parallel to those in audition where a signal-to-noise ratio is manipulated or where portions of a sound message are deleted.

6.68 In a more classical psycho-physical setting, workers such as Gibson have developed theories and conducted research on the decoding of visual stimulus patterns. If, for example, a stimulus with a textured surface is presented in such a fashion that the density gradient of the texture increases toward the top of the figure, what kind of decoding and response will the subject make? Will this be perceived as a floor receding from the individual or as a ceiling receding or as a wall tilted at a particular angle?

6.7 The Receiver

6.71 The receiver in communication has received more research attention than any of the other factors in our model. Much of this research has been the "audience research" of the mass communicator. We shall cite here some relevant research findings, selecting for illustration studies that show the operation of some of the more important variables relating to the receiver.

6.72 Intellectual ability is an important variable. In general, it has been defined in research practice as the education of the respondent. Although this is probably not the most satisfactory operational definition, and perhaps not as satisfactory as a general intelligence test score, it is nevertheless probably quite adequate, general intelligence and education being correlated. Opinion change is correlated with intellectual ability, as Hovland, Lumsdaine, and Sheffield have reported. They found that there was an increasing effect of a communication with increasing education of the audience. However, and this is an important point, there was also correlated with intellectual ability greater resistance to change of opinion, if the communication was detectably biased.

6.73. In some instances, when the communication was perceived as biased, there was a "boomerang" effect; individuals were made to change their opinion in a direction opposite to that advocated by the communication. An additional finding by this group of researchers was that opinion items which were positively correlated with education were changed positively, that is, in the direction of the communication, whereas items which correlated negatively were changed negatively, that is, in a direction opposite to that advocated by the communication.

6.74 Let us assume for the sake of illustration that favorable opinions towards anti-segregation are associated with higher education, and let us assume further that favorable attitudes toward high tariffs are negatively associated with high education. Under these circumstances, the communication advocating anti-segregation would be more likely to effect attitude change among persons of higher education in a mixed audience, while a communication advocating high tariffs would have an opposite effect. In the first case, individuals of better education would be moved in the direction of the communication, whereas in the second case, they would be moved in a direction opposite to that of the communication.

6.75 The effectiveness of a persuasive communication is also primarily affected by the initial position of the recipient, relative to that of the communication. Theoretically, two different effects have been hypothesized. The view adopted by Hovland *et al* is that with small discrepancies between the position of the recipient and the posi-

tion of the communication, there will be more attitude change than with large discrepancies between the two. The hypothesis is an extension of Helson's adaptation level theory. When the discrepancy is small, assimilation is expected; when the discrepancy is large, a contrast effect is expected. Some of the research results of the Hovland group support this hypothesis.

6.76 The second position is that with increasing discrepancy there will be increasing attitude change; this position, held by Festinger, derives from his theory of cognitive dissonance. Empirical evidence also supports this hypothesis. In general, more studies have found that with increasing discrepancy there is more change, than the opposite.

6.77 The two positions, however, can be reconciled with Festinger's theory of cognitive dissonance: when there is a discrepancy between the position of the recipient and that of the communication, dissonance will result for the recipient, and there will be pressures to reduce the dissonance. Two means of reducing the dissonance are available to the recipient. One is to change his opinion in the direction of the communication and, hence, to reduce the discrepancy. Another is to reject the communication, or to generally discredit it. If the credibility of the communicator is high, the former means is more likely. If, on the other hand, the credibility of the communication or communicator is low, the more likely dissonance-reducing response is to discredit the communication.

6.78 In situations where the communicator is of moderate or low credibility and the communication is addressed to a large group of individuals, it is quite possible that the two effects will more or less cancel each other out, so that there is no relationship between amount of discrepancy and amount of opinion or attitude change. This results from the fact that with increasing discrepancy, there is increasing attitude change with some individuals, whereas for others there is increased rejection. Attitude change studies by Adams, Maccoby, Maccoby, and Romney appear to support this latter finding.

6.79 The same researchers have shown that the importance or relevance of a communication to the recipient will affect his response to the communication in a number of ways. For receivers to whom the communication was important the research showed a longer lasting attitude or opinion change than for those to whom it was less important and less relevant. It further showed that individuals, when given the opportunity to request a pamphlet, were significantly more likely to do so if the pamphlet was important and relevant to them. Finally, the research indicated that if a communication was sent out to individuals unsolicited, those to whom it was more important and relevant were most likely to attend to it. These findings are consonant with those of Schachter in an experimental study of deviation, rejection, and communication. Schachter showed that group members were more likely to address communications to deviate or delinquent members, if the activities of the group at the time were relevant to the group's goals (in this case, of course, the relevance is to the communicators rather than to the recipients).

6.7.10 Importance and relevance have also been treated theoretically by Festinger. He has hypothesized that as importance and relevance increase, the magnitude of dissonance produced in any dissonance-producing situation will increase. From the point of view of communication research this means that for a given amount of discrepancy between the position advocated by a communication and the position of a recipient, there will be increasing pressures to change as importance and relevance increases. The studies by Maccoby, Maccoby, Romney, and Adams support this conclusion.

6.7.11 Group membership variables affect reception of a communication. Kelley and Volkart showed that there was a high negative correlation between the evaluation that Boy Scouts made of their troops, and attitude change. In this study a communication derogating certain practices and beliefs of Boy Scouts was addressed to the troop members. Those Boy Scouts who had the highest evaluation of their troop were least likely to be affected by the communication, whereas those who held their troop in lower esteem were most susceptible to change. The magnitude of the negative correlation between evaluation of the troop and change was —.71. In another study Kelley showed that the momentary salience, or heightened awareness, of group membership affected response to a communication. Specifically, he found that group-anchored attitudes, in this case attitudes about Catholicism, are much more resistant to counter-pressures if group membership is salient than if not. Salience in this case was experimentally manipulated by prior discussion.

6.7.12 Studies by Kelley and by Thibaut on the relationship between social status and communication, and a study by Back, *et al*, on rumor transmission show the effects of status differentials on communication. The study by Kelley is

perhaps the most comprehensive in this respect. He experimentally created two-level hierarchies in which the participants engaged in problem solving tests, during which they could and did communicate between the hierarchical levels as well as within a given level. Control subjects were run in the same problem-solving situation but were not differentiated on the status dimension. They found that under these conditions there was more communication between subgroups in the control condition than in the condition where there were status differentials. In the latter condition he found that subjects in the low status group were much less likely to direct hostility upward toward the higher status group than members of the higher status group were to direct hostility downward.

6.7.13 Interestingly, he also found that lower status members were especially likely to communicate upwards in a hierarchy. He theorized that they did this as a substitute means of upward mobility. Another interesting finding, in this case regarding the content of communication, is that the more unpleasant a position in a hierarchy (in this case, lower status) the stronger the likelihood for the individual to communicate task-irrelevant material. Kelley explained such communication as serving the function of escaping from an unpleasant situation.

6.7.14 His findings are in accord with the earlier ones of Thibaut, which showed that as discrimination in favor of higher status groups increased, the amount of communication addressed by low status groups to high status groups increased. Associated with this was a decrease in aggressive or hostile communication. The study by Back, *et al*, on rumor transmission also lends support. These researchers observed strong tendencies to communicate upward in an organizational hierarchy. There were also indications in their study that information transmissions of persons higher in the hierarchy was restrained.

6.7.15 Important recent theoretical contributions by Festinger throw further light on the recipient of a communication. The important variable to be considered here is the post-decision state of the individual. Festinger theorizes that whenever a decision is made which entails choice among alternative courses of action, dissonance will be produced in the individual. The amount of dissonance produced by the decision will be a function of the relative attractiveness of the alternatives not selected to the alternative selected, and of the importance of the decision. In turn, the individual's subsequent exposure to communications relevant to the decision will be a function of the magnitude of dissonance produced by the decision. Theoretically, it is expected that the greater the dissonance, the more selective subsequent exposure to communications will be, and the more exposure there will be. This follows from the fact that dissonance may be effectively reduced by acquiring information consonant with the chosen alternative.

6.7.16 An experimental study by Ehrlich, Guttmann, Schonbach, and Mills tested these derivations from dissonance theory. Their study basically involved interviewing purchasers of new automobiles about their reading of automobile advertisements immediately following their decision to buy the new car. The findings showed that new car owners were more likely to notice advertisements about the car they had bought than about other cars. Furthermore, they were more likely to notice advertisements about their own car than were individuals who had not bought a new car. In addition, among those who had noticed advertisements, the new car owners were far more likely to read the advertisements than were the individuals who had not purchased a new car.

6.7.17 Finally, we may mention personality characteristics of the recipient as important variables in the communication process. Interest in these variables in the specific context of persuasive communication is relatively recent. The work done to date is nevertheless impressive, and recently a volume by the Yale group has been devoted to the subject. Janis and Cohen have studied the relationship between self-esteem and influence-ability. The study by Janis clearly shows that low self-esteem is associated with influenceability. A further study by Janis shows that anxiety neurosis and the presence of obsessional symptoms is, on the other hand, associated with resistance to persuasion.

6.7.18 In somewhat broader explorations in the relationship of personality characteristics to persuasibility, Janis and Field have found that feelings of social inadequacy (which are related to self-esteem), social inhibitions, richness of fan[illegible]y and argumentativeness are positively and significantly correlated with persuasibility. In addition, hyper-aggressiveness is nearly significantly related to persuasibility (p—.08). In every case, however, the correlations coefficients are extremely small, the highest being .27, and they are significant only in the case of male subjects. Among female subjects, not one of the nine personality characteristics studied were significantly related to persuasibility. The nine personality

characteristics studied were feelings of social inadequacy, social inhibitions, test anxiety, richness of fantasy, argumentativeness, hyper-aggressiveness, suspiciousness, obsessive-compulsive symptoms, and neurotic anxiety symptoms.

6.7.19 A person's need for cognition is a further variable associated with communication processes. Need for cognition is a construct developed by Cohen, who also developed a measure of it. It refers to a need by the individual to structure and make meaningful relevant situations. Adams hypothesized that if a need for cognition does in fact exist, it should be found that information seeking should be positively correlated with need for cognition, but only when the source of information had previously effectively reduced the need. Testing this hypothesis with a group of mothers, he found, as predicted, that mothers with high need for cognition were especially likely to actively seek information on child care from physicians and pediatricians, but that there was no relationship between need for cognition and information seeking when the information was sought from psychological and school counselors. The prediction was based on the assumptions that doctors and pediatricians would have, in the past, reduced their patients' need for cognition, whereas psychological and school counselors had not.

6.8 Summary

6.81 We have selected a six-part model of the communication process and have used this model in organizing our discussion of communications research. Insofar as possible we have cited representative experimental, rather than field, studies and have further tried to select the more important studies bearing on each of the six factors in the model. Much relevant research has, of course, been omitted.

6.82 Beginning with the immediate post-World-War-II years, communication research has grown rapidly. The growth, however, has not been an uncontrolled one. The research is progressively becoming systematically related to theory, though, as yet, there is no single theory that subsumes all aspects of communication. Furthermore, the research conducted has become programmatic: an excellent example of this is the work of the Yale group under the leadership of Carl Hovland. More and more work from different subareas of psychology and other disciplines is being interrelated and integrated. An example of the attempt to integrate is found in the first half of the volume by Katz and Lazarsfeld entitled *Personal Influence*. As a result of all this, the distinction between interpersonal and mass communication is to some extent disappearing.

7. Perception and Visual Communication

prepared by I. A. Taylor

7.1 Introduction

7.11 The purpose of this section is to explore and develop the perceptual bases of visual communication. Examination of the communication process in general has been largely limited to verbal forms of symbolization. The apparent neglect of nonverbal visual forms is quite clearly not due to their unimportance, for even a cursory examination of contemporary life will reveal the overwhelming importance of visual symbols in our daily life not least of which are in the various arts and sciences. The neglect is probably due to the complexity of these symbols, particularly their continuous nature in distinction to the discrete, elementary nature of words and numbers.

7.12 In examining the nature of visual communication, many concepts and principles of various perceptual theories will be formulated and expanded into a systematic framework. The problem of this investigation, therefore, is to apply these basic principles, thus contributing toward a nonverbal syntax.

7.2 Visual Perception

7.21 One of the most important aspects of visual communication is perception. Perception is often defined as awareness of objects in the environment. Although this definition is misleading, in that it says too much and too little about perception, it indicates only that perception has been considered as one of the most central problems in psychology. It would be difficult to describe the whole of life if we were unable to be aware of objects in the world through sight, sound, scent, taste, touch, the experiences of hot, cold, pain, equilibrium, and muscular tone, to mention the most important sensations. It will be noted also, that more than five senses were mentioned. It was Aristotle who first suggested that there are five senses. Today, due to experimentation, we know that man possesses a dozen or more senses — the exact number is still unknown.

7.22 One of the earliest theories of perception dates back to the Epicurean Greek philosophers. They believed that objects emit something of themselves to our eyes, which allows us to see them. This theory, of course, developed before we understood the nature of optics. After Galileo and Newton helped us to understand the nature of light reflection and the use of the lens to produce an image, it was generally believed that the object, rather than emitting something of itself, reflected light to our eyes, very much as in a camera. The image in our eye, or specifically, on our retina, was supposed to be an *exact* copy of the object. Experiments soon provided abundant evidence that the eye does not always give a true copy of the object, but changes it in many ways. For example, optical illusions demonstrate that our eyes do not record actual measurements.

7.23 A third view or theory therefore developed. It proposes that a perception is an *interaction* between the perceiver and the object perceived. An example will make this clear. We know today that sunlight, composed of all the colors of the rainbow, looks green to us when it falls on grass, because the grass absorbs all of the light waves except green. The light wave corresponding to green is not "green" until certain cells in the retina of the eye interact in some way with the light wave to produce the experience of green. Neither the light reflected from the grass nor the particular sensory cell in the eye sensitive to that light wave, is green. The interaction between the two produces a perception of green.

7.24 A fourth and more recent view goes beyond the idea of interaction and insists that every perception is a *transaction* — that the various objects that are perceived exist only in terms of the situation of perceiving them. There are two major principles of this approach as formulated by Ittelson:

1. That all parts of the situation enter into it as active participants.
2. That they owe their very existence as en-

countered in the situation to this fact of active participation and do not appear as already existing entities merely interacting with each other without affecting their own identity.

7.25 This development from the Epicurean to the transaction approach involves an interesting shift of direction in perception. The shift is from the object emitting something of itself to the eye, to the eye's "externalizing" the perception.

7.3 The Visual Field

7.31 The visual field can be defined for our purposes as all that which is perceived by the eyes at a given moment. See Fig. 7.1 for a simplified drawing of the eye. The major aspects of the field are the edges bounding the field, the *perimeter*, the space within the perimeter, and the shapes, colors and objects within the space. Each eye, in a sense, has a different field. When the two eyes fixate on an object, the fields overlap, but do not coincide, as seen in Fig. 7.2.

7.4 Visual Sensations

7.41 When we look at a sunset, we do not see a certain number of colors, lines or shapes. In an important sense, we see a sunset. We are conscious of sensation elements, but these are vague and secondary to the total visual experience. The sensations seem to relate in such a way as to give the various parts their meanings only in terms of the sunset experience. The reactions we have toward particular sensations depend upon the context. Bright oranges, reds and yellows will do for a sunset but not for wallpaper.

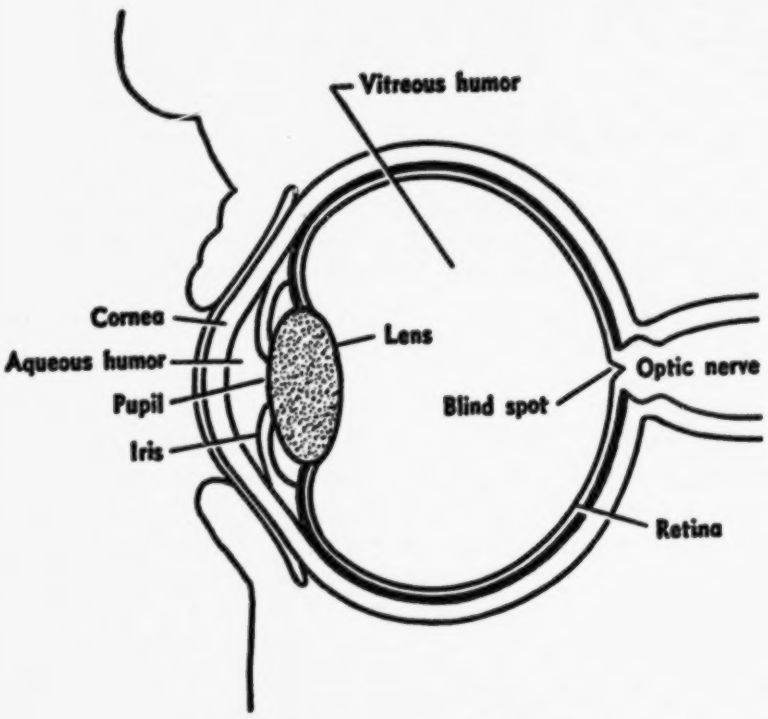


Fig. 7.1. The eye and its parts.

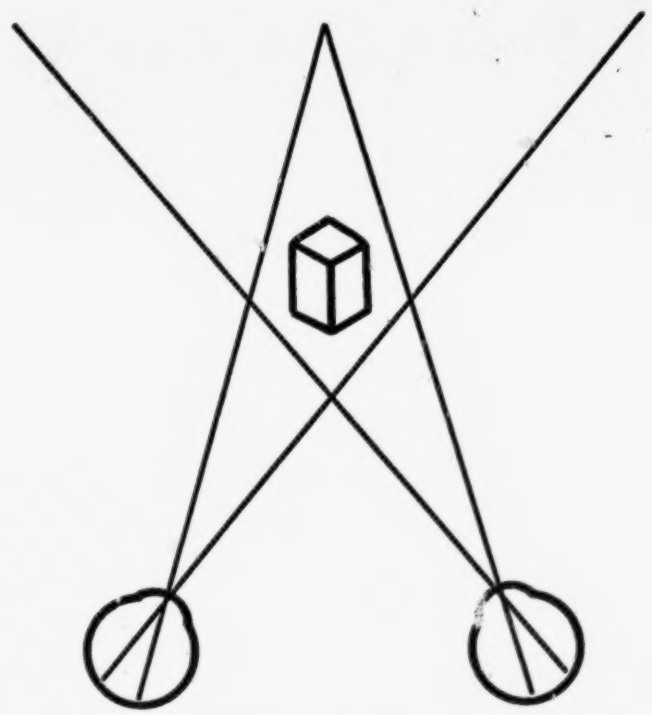


Fig. 7.2. The overlapping fields of the eyes.

7.42 It is misleading, therefore, to discuss specific sensations independent of a total perception. As every good designer of visual symbols knows, almost any design element can be used to produce a wide variety of reactions, depending on its *relation* to the design. If the relation between sensations is retained, however, it can be *transposed* into another situation without loss of essential meaning. That is why we can still recognize a song whether it is played by any particular instrument or sung by voice, because even though the specific elements or sensations are changed, the relations remain.

7.43 An understanding of the components in the visual field, however, will be useful for manipulation when producing a visual design or symbol for communication. A *line*, one of the simplest elements of design, divides space. It can be used to produce the perception of a contour or a boundary. Actually a line involves relationships within itself and to its surroundings. Internal relations are indicated by the straightness or curvature of the line, produced by the relationship of various parts of the line. The line relative to its surroundings produces the perception of line direction. Manipulation of line can produce various effects.

7.44 A vertical line seems to most observers to be associated with tension and generally produces more excitement than a horizontal line, which is more associated with standing erect and reclining. A diagonal line for similar reasons may produce discomfort to an observer because of its lack of balance.

7.45 The positioning of shapes with regard to a vertical can produce interesting effects. If a bending man is shown above the diagonal, he is merely seen as bending over — say, to pick something up. The reason for the bending seems to have an external cause. If he is placed beneath the diagonal, the perception is changed. Now he is bent as if by the weight of the world (or space) above him (Fig. 7.3).

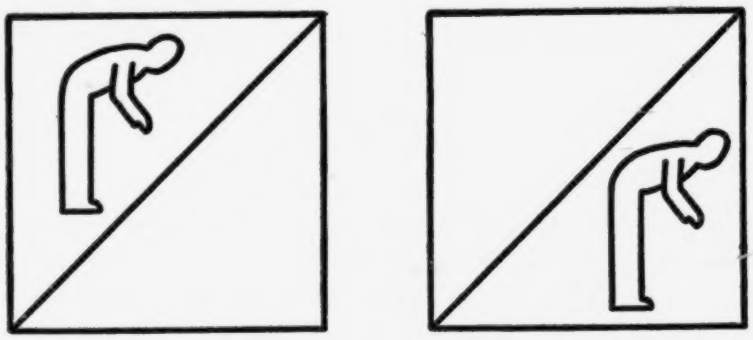


Fig. 7.3. The effects of positioning above and below the diagonal.

7.46 Simple *shapes* are another important part of the visual field. We tend to think of shapes as regular or irregular, symmetrical or asymmetrical. Although shapes can be constructed from lines, it is not generally true that we see the lines when we see a given shape. For example, the triangle has a unique meaning of its own. Even the change of position of a shape produces an entirely new experience, one that may even have a different name, as when a square is rotated into a diamond (Fig. 7.4).

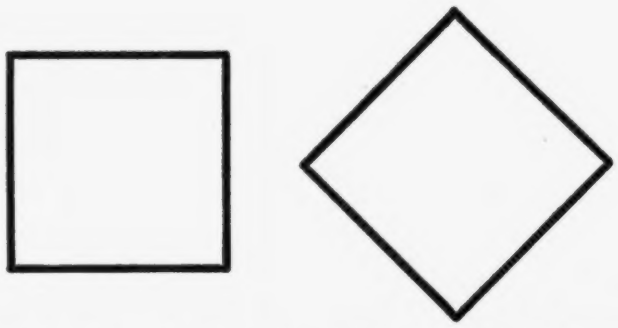


Fig. 7.4. Changing the "meaning" of a shape by rotating it.

7.47 Various shapes have become associated with everyday ideas for physical, physiological, psychological or social reasons. A circle, which has the unique property of having equal radii, is frequently accepted as the shape of a community or the shape of a group in conference largely because the elements distributed on the circumference are in an ideal position for interaction with each other or central elements. Shape metaphors have gravitated into verbal language. Such concepts as "square," "deep," "angular," "expensive," etc., have become meaningful expressions in describing people. There is also in our culture a high degree of reliability in associating various shapes (as well as other field parts) with emotions.

7.48 The psychology of *color* has been intensively studied by physicists and psychologists. The experience of color is related on the one hand to sensory cells (called *cones*) in the retina of the eye, and to light-wave variations, on the other.

7.49 Color, which Newton showed to be an ingredient of light from the sun, the composite of all colors, can be separated in the form of the familiar rainbow or spectrum, by passing light through a prism (Fig. 7.5).

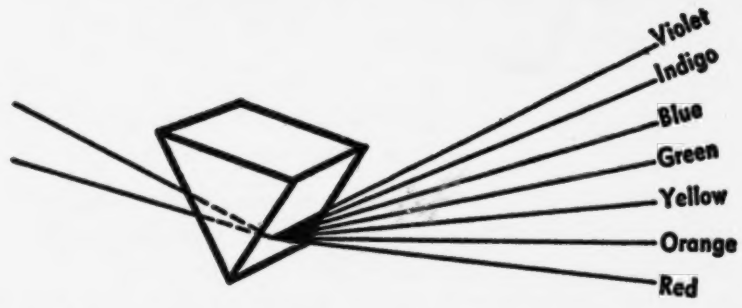


Fig. 7.5. Light breaking into its component colors passing through a spectrum.

7.4.10 The wave lengths are longer toward the red end and shorter in the direction of the violet. Beyond these two points, which range from 1/31,250 to 1/62,131 of an inch in length, the impingements of waves are not perceived as light. Many insects perceive ultraviolet as a color because they possess sensory cells to respond to it as a color experience. Theoretically, all these other waves which come to us indirectly known as radio, radar, x-rays, cosmic and other types of rays could be perceived as color if humans possessed special sensory cells to interpret them as such.

7.4.11 In visual communication it is not possible to utilize all of the colors that are

perceived. The intensity of sunlight, for example, is 500,000 times the intensity of full moonlight, but white paper is only 60 times lighter than black paper. This limitation, however, is not as important as it may seem, for the eye can adjust in many ways to increase or reduce the intensity of the light.

7.5 Visual Modulations

7.51 The eye or both eyes in conjunction are capable of several important types of movement. These movements, which occur without too much attention, are essential in perceiving. By referring to the figure of the human eye (Fig. 7.1) it is possible to describe the more important movements. Probably the simplest visual movement is the *accommodation* of the eye to variations of light intensity, as shown in Fig. 7.6.

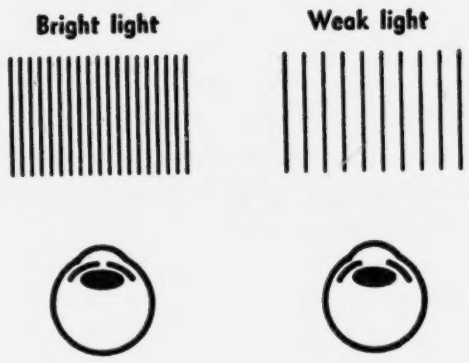


Fig. 7.6. Accommodation of the eye to light.

This adjustment, to a large extent, resembles the diaphragm adjustment in a camera. Under bright sunlight the lens opening is made smaller to reduce the amount of light entering the camera. Additional light is necessary when there is less light available, and the lens opening is correspondingly opened to enable the proper amount of light to enter.

7.52 Similarly, the pupillary adjustment of the eye constricts in excessive light and opens when the light is dim. Actually, pupillary adjustment to light comes about by contraction of the iris, for which purpose there are six ocular muscles. This pupillary change explains why a white piece of paper appears to be about the same brightness under sunlight or moonlight, even though the former is 500,000 times brighter than full moonlight. This is known as *brightness constancy*.

7.53 Actually, the *retina* (containing the visual sensory cells) adjusts to light to a larger extent than the lens. The changes in the retina, according to Budenbrock, are somewhat similar in this respect to the various ASA speeds of various films.

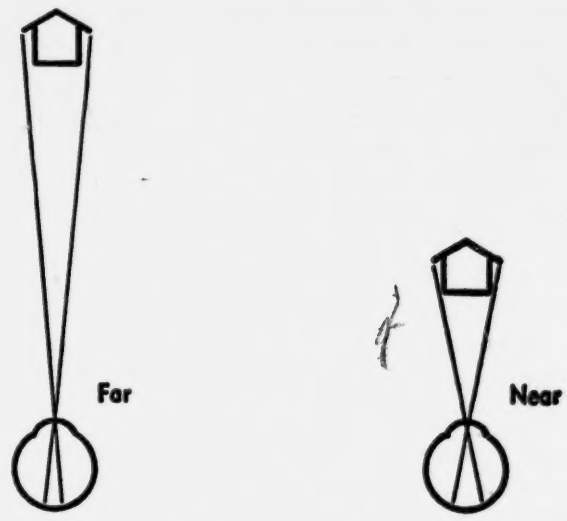


Fig. 7.7. Adjustment of the eye to distance.

7.54 Another important eye movement is *adjustment* of the lens to objects at various distances, as shown in Fig. 7.7. This unique quality of the eye allows us to fixate, or focus, upon objects with distances ranging from within several inches to infinite distance. If we were to continue our analogy to the camera, this would correspond to the focusing of the lens. Although only a relatively small area of the visual field (about 25 inches at a distance of 8 to 10 inches) is clearly in focus at any given moment, we see clearly a large portion of the visual field over a period of time because of the rapid jerky *eye movement*, another important means of modulating the eye.

7.55 When we consider both eyes, the *convergence* of the eye on an object is noteworthy (Fig. 7.8). For centuries, this type of eye move-

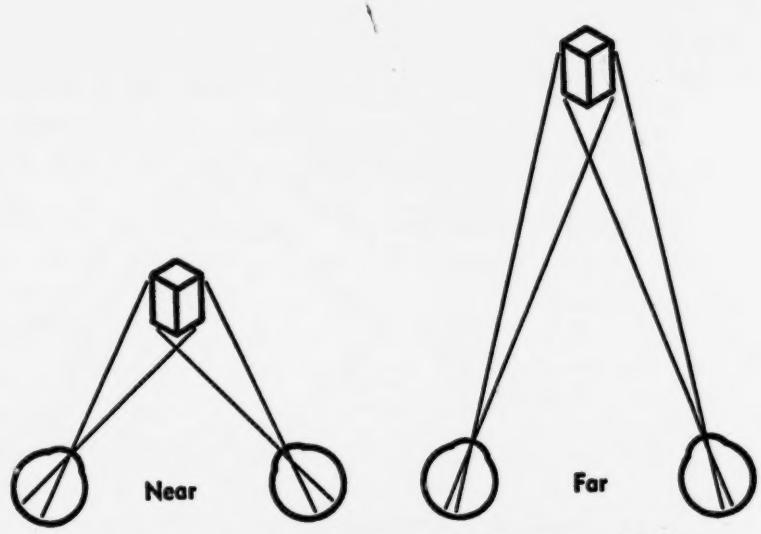


Fig. 7.8. Convergence of the eye on an object.

ment was ignored. Leonardo da Vinci was perhaps the first to seriously explore *binocular vision*, or the effects of having two eyes. He noticed that when an object was several inches away from his eyes, a paradox occurred: another object placed behind the first was visible under certain conditions.

7.56 A few centuries later, Wheatstone was the first to realize the implications of the parallax. The implication that each eye sees a different image, which may be considerably different at close distances and negligibly different for distances beyond several feet, led Wheatstone to contruct the first *stereoscope*, an instrument which has again gained popularity in recent years.

7.57 The fact that each eye receives a different image to a large extent answers the question raised by da Vinci as to why a painting cannot completely capture the dynamic quality of depth involved in direct vision. Assuming that an artist can duplicate the qualities of light and texture, if he were to paint two pictures of an object, each corresponding to a position seen by each eye, and present this in a suitable stereoscope, we probably would be unable to detect the difference between the merged paintings and direct vision.

7.6 Visual Discrimination

7.61 There are two important kinds of perceptual discriminations. The first, which does not directly concern us, has to do with the detection of upper or maximal and lower or minimal stimuli. For example, the human ear can respond to vibrations ranging from approximately 12 to 20,000 per second. We perceive these as sound. The eye can respond to waves with wave lengths ranging from about 1/31,000 to 1/62,000 waves per inch. Above and below these limits, the waves are not detected as light, but may be interpreted as other phenomena, such as radio waves, heat, gamma rays, etc.

7.62 The second kind of discrimination of importance to visual communication, is the detection of noticeable differences between stimuli within this range of perception. Actually, there is no direct one-to-one correspondence between a perceived difference and the actual difference between the two. One general principle relevant here is that in estimating the size of an object the size of the error increases with the size of the object.

7.63 In general, the normal eye can respond to more than 150 gradations of color, or hue, 200 gradations of value or brightness, and 20 gradations of chroma or saturation. Extensive as this may sound, it is a very narrow band of the known wave lengths.

7.7 Perceptual Organization

7.71 Most of us take for granted the process of perceiving. It is one of the easiest human processes to ignore since it is more compelling to give attention to the *objects* of perception. We attend to what we see, not to the process of seeing itself. Also, because the nature of perception is so highly personal — that is, composed of experiences that are available only to the perceiver — little, comparatively, in the way of concrete knowledge is known of it. This, despite the fact that it is easily the most studied subject in the field of psychology.

7.72 Some of the major philosophical battles have been fought over basic questions as to the process of perceiving an object. Although we need not be overly concerned with the philosophic issues here, the implications of some of these are extremely pertinent to our discussion.

7.73 In everyday life, we frequently assume that our perceptual apparatus gives us an accurate account of the external world as it really exists independent of our sensory equipment and nervous systems. If there are any deviations in perception, we consider them "illusions," "color-blindness," and other forms of aberration.

7.74 It was John Locke, a seventeenth century philosopher concerned with the functioning of the mind, who formulated the idea that objects possess primary and secondary qualities. The primary ones such as size belong to the object and such secondary qualities as color to the perceiver.

7.75 It was not long before another philosopher, Berkeley, questioned whether an object had any primary characteristics at all, since its size and other body characteristics come to us through perception and always are relative in meaning to other perceptions.

7.76 Hume completed this line of logic by reasoning that even the mind must be perceived if we are to be aware of it.

7.77 Therefore, all that we know of the world about us is perceptual in nature. Another way of saying this is that all our lofty principles, concepts, and theories about the external world tell us more about the nature of perceiving than about the world.

7.78 This type of *solipsism*, a term indicating that we are encased in our own nervous system and have no direct way of knowing anything about external reality, was strongly repelling to many subsequent and present-day investigators.

7.79 Gestalt psychology, developed in the early part of this century, had as one of its principal arguments that there are certain basic principles of form organization inherent in the physical organization of the world. In the discussion that follows it will be largely these principles of form which will clarify the role played by forms, the relationship between forms, and the bases for producing meaning through visual symbols.

7.8 Development of Perception

7.81 When we look at a visual symbol, or group of visual symbols (for example, a map), we can observe a general process for all persons, provided the map has not been seen before. For a moment we may not even recognize what class of visual is before us. When we do recognize it as a map we still perceive only vague shapes, colors, lines, and words. Slowly the various elements begin to relate to each other.

7.82 At first we may recognize that certain areas represent land and others water — this, relatively quickly, if the representations are done in a familiar manner; much slower if strangely new colors are used to designate land and water; very slowly if the manner of representation is reversed. Many people have a great deal of difficulty in identifying what is being represented in the map in Fig. 7.9.

Fig. 7.9. What famous Sea?

7.83 We may have difficulty in recognizing Italy (Fig. 7.9), for example, protruding into the Mediterranean Sea. That is because we have learned to associate map lines as belonging to land and the land areas as generally darker than water areas. We do not see the line defining Italy, therefore, since it is assimilated into the unfamiliar shape of the Mediterranean Sea.

7.84 No matter how familiar we may be with a particular shape, we may not perceive it if it is imbedded in a larger design in which its bordering lines are lost to another shape. Some good examples (adapted from Gottschaldt) are shown in Fig. 7.10.

7.85 Returning to our perception of a map, after larger areas are identified, smaller, internal relations begin to emerge — rivers, roads, lakes, cities, etc. At first, various sections may be recognized without any clear recognition of their relationships. Finally, the various parts become coherently related. A road is seen to connect three large cities, two of which have ports on the same river, etc.

7.86 This is much like the situation of entering a factory for the first time. At first, everything is inarticulate. Soon we distinguish various sounds, machines, and areas from others. Finally, after a necessary period of time has elapsed, the various parts form into a meaningful whole.

7.87 The psychologist Gardner Murphy has identified and described the basic stages of perception as follows:

7.88 *The diffusion phase.* This is the initial phase of perception, both in the development of perception in children or in the initial perception of a complex configuration for the first time. The field is inarticulate and undifferentiated. Because the perception of depth in space requires a great deal of articulation, the visual field during the diffusion phase is flat and unextended. This would indicate that the diffusion phase in perception is "primitive" in nature. Because of its lack of differentiation, its appearance may be nebulous or soupy, as during a fog, and may invoke feelings of instability.

7.89 Contemporary abstract art affords many examples of visual symbols conceived in an atmosphere of diffuse perception. Appreciation of art of this nature therefore probably depends upon one's attitude and tolerance toward ambiguity.

7.8.10 *The differentiation phase.* During this second phase, either in the perceptual development in children or in the initial viewing of an object, elements begin to segregate and can be identified by the perceiver. The relationships between these elements still remain unclear. The phase is highly analytic and inductive in the sense that the viewer is striving to relate the parts

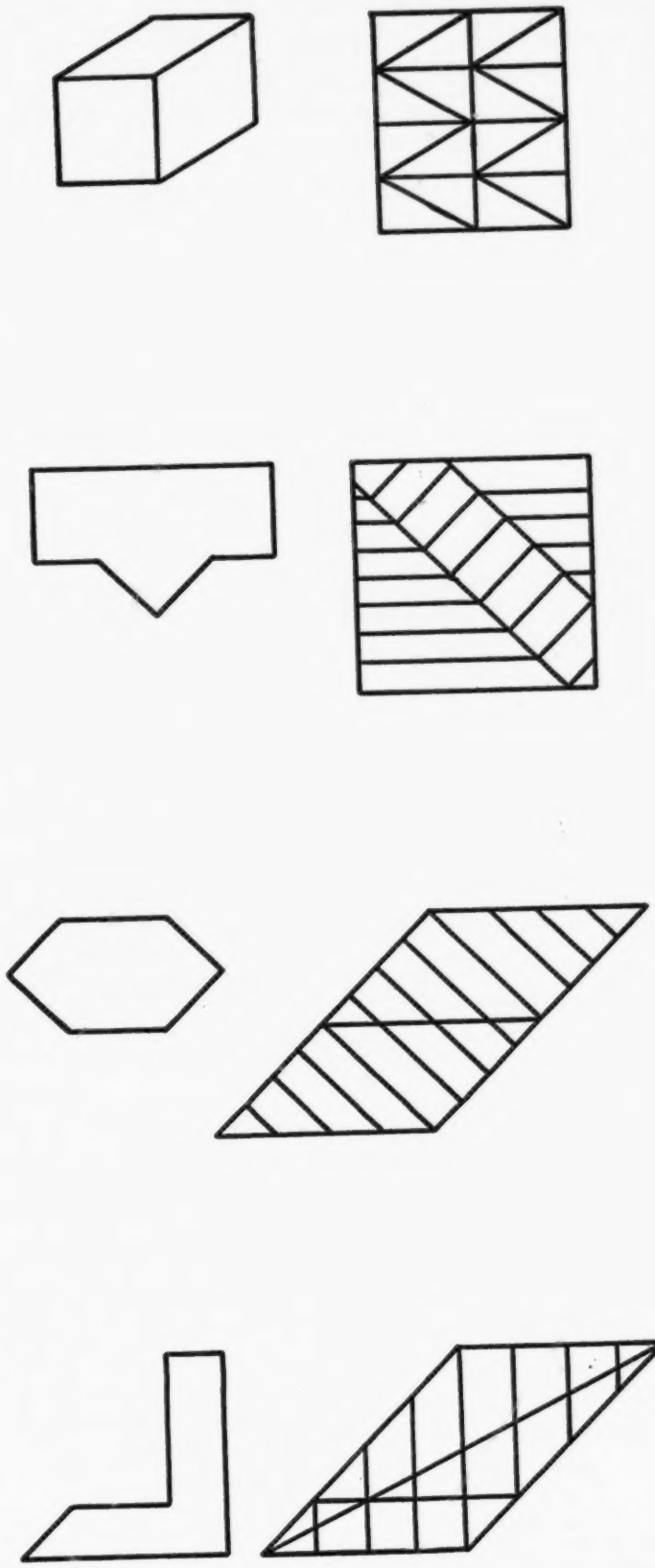


Fig. 7.10. Find the figure on the left in the figure on the right.

into a coherent organization. It would seem that visual communication executed during this phase would be disjointed and incoherent.

7.8.11 Unskilled craftsmen, for example, may draft a human figure composed only of proportionate and perhaps misplaced body parts, as we find so frequently in the drawings of children. This, of course, is not to be confused with the purposeful distortion found in the work of highly skilled designers and artists.

7.8.12 *The integration phase.* The final phase of perceptual development or in observation occurs when the various articulated elements are composed into a coherent pattern. This may occur rapidly as an experience in insight or more slowly through trial-and-error assemblage. Integration has several important identifiable characteristics which make for its high degree of communication. It is efficient in the sense that there is the proper amount of material to produce understanding. It is simple in that there is a minimum of or no adornment. Finally, it is reliable in that it evokes similar responses among many people in the same culture.

7.8.13 One should not, however, confuse *integrated* visual communication with draftsmanship or artistic ability. This would be as misleading as confusing verbal language with oratory or poetry. One can use verbal language articulately and coherently without being an artist. We distinguish in verbal language between poetry and prose. Unfortunately, we do not have the same distinction in non-verbal visual communication. A highly integrated visual communication, where artistry and craftsmanship are unimportant and where communication is high, is found in Schramm's visualization of the communication process, or in the representation of the growth of a city, in Fig. 7.11.

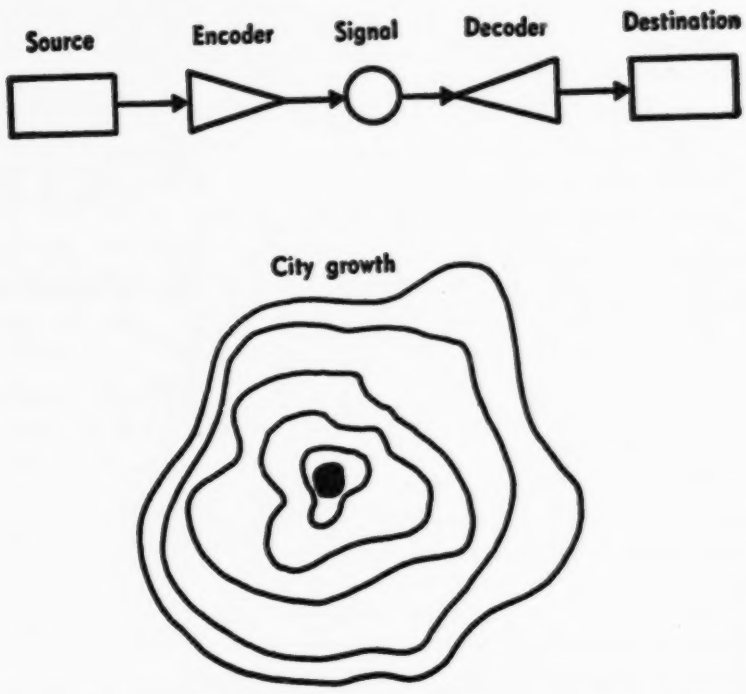


Fig. 7.11. Highly articulate nonverbal forms of visual communication.

7.8.14 Each of these phases of perception can provide a different framework for visual communication, depending on one's purpose. An important point is that in presenting visual communications, one should carefully consider the amount of time necessary to allow the "reader" to comprehend what he sees, to evaluate through the phases of perception. Fig. 7.12 shows an hypothetical development of perception.

Fig. 7.12. Stages in the development of perception.

7.9 Structure of Visual Perception

7.91 What happens during this perceptual process? How is each phase achieved and how is the transition between phases accomplished? In answering these questions it is necessary to focus on the *structural* characteristics of visual communication.

7.92 Structure refers to the distribution of materials in space and through time. Various visual communication media are essentially *spatial* in that all parts are presented simultaneously for inspection, as for example, a photograph. The communication becomes *temporal* when the spatial elements evolve through time, as in a television program.

7.93 The outline below is concerned with the basic principles involved in perception. The first group is concerned with those principles that describe and explain the process of grouping objects or elements into perceived units. A second group is concerned with the segregation of units from each other. Finally, those principles concerned with relating all of the visual elements coherently into a single pattern are described.

7.94 1. *Principles of visual grouping.* Visual elements may combine in one of two different ways. In the first, the elements form a unit, although each of these elements still maintains its separate identity. An example of this type of grouping is a flock of birds, a committee, or a visual scene. The group is one by *summation.* In the second kind of grouping, the elements lose their identity in forming a whole. Geometric figures are good examples of this type of grouping. A circle, for example, is not seen as a group of arcs. The mixture of red and blue-green light producing yellow light, and of course, of all colors forming white light, according to Newton's famous experiment, are further examples.

7.95 a. *Weak groups.* The following three principles involve the most important ways of forming visual units out of discrete elements:

7.96 (1) *Proximity.* The simplest way of relating two or more elements is to have them close together, either in space or time. The *proximity* of elements, as seen in Fig. 7.13, is

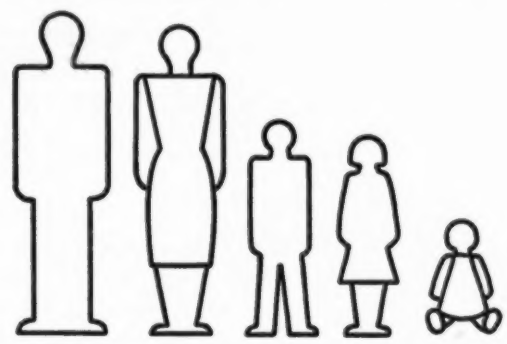


Fig. 7.13. Proximity of elements.

responsible for the spontaneous formation of groups. In everyday experience we tend to associate certain objects or persons, such as the members of a family, as seen in Fig. 7.13.

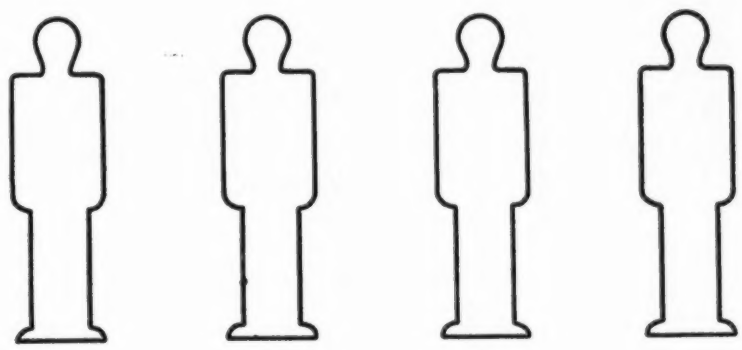


Fig. 7.14. Similarity of elements.

7.97 (2) *Similarity.* Of almost equal simplicity is this principle, which is responsible for the grouping of objects which need not be close together. The grouping of course is produced by common features of the various elements.

This is the fundamental principle underlying our classification of various religious, racial and economic groups. An interior designer may unite the elements of an interior by repeating colors or shapes in various parts of the room. A combination of proximity and similarity can be extremely effective in grouping in a visual, as shown in Fig. 7.15.

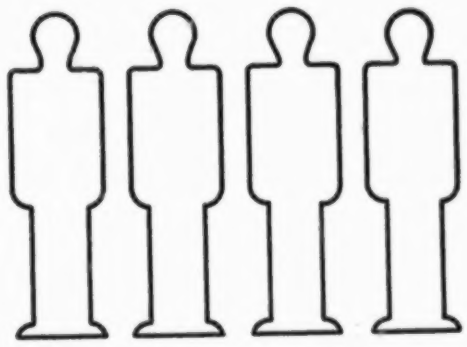


Fig. 7.15. Grouping by both proximity and similarity.

7.98 (3) *Common movement.* In general, objects which move in a similar way are related to each other, as when several birds from a flock veer away together from the main group.

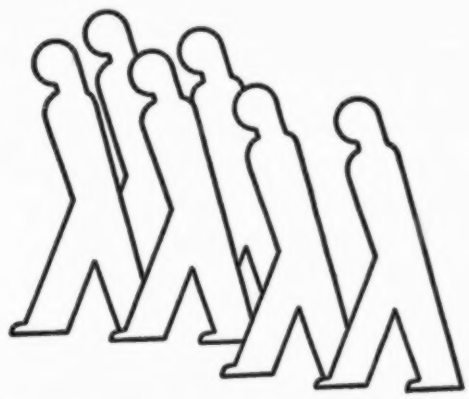


Fig. 7.16. Common movement of elements.

7.99 b. *Strong units.* Visual situations where the elements lose their identity in combining to form a whole, which then has unique properties of its own, provide a different kind of visual statement. Geometric designs to a large extent possess this property. Frequently in visual communication individual elements are lost in the total configurations by one or more of the following principles of strong grouping.

7.9.11 (1) *Good continuity.* Elements which form a good contour by being perceived in continuity form a unit. A good example is the evening skyline of New York. Also, because of continuity, two crossing lines are perceived as two crossing lines, rather than four lines. Frequently in visual communication, what we generally mean by organization — having the elements fall into relationship to each other in terms of a general category—is the essential meaning of good continuity. Many otherwise diverse elements become related when they are brought into continuity (see Fig. 7.17).

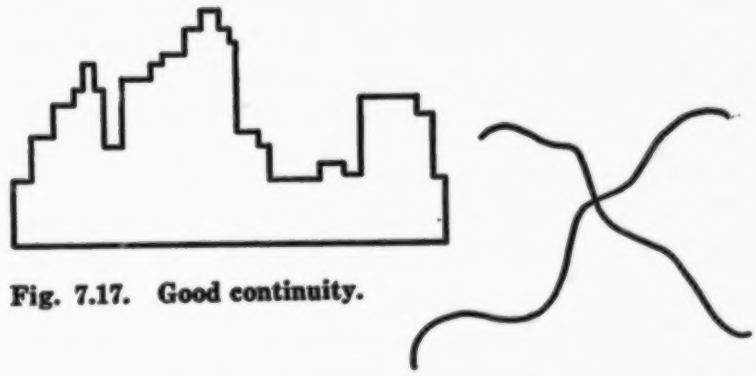


Fig. 7.17. Good continuity.

7.9.11 (2) *Closure.* Probably one of the most dynamic properties of perceived shapes is the tendency toward closure or completion. Bobitt, for example, flashed incomplete triangles to subjects through an instrument called a *tachistoscope,* which allows rapid exposure of material. At a certain speed and a certain degree of incompleteness of the triangle, the triangle was actually perceived as complete. The brain, in perceiving, provided the part which would permit a closure.

7.9.12 An unclosed configuration tends to produce tension in the viewer and a longer memory for the figure. In perceiving an open form, there is a tendency for it to change toward a more familiar closed one. When suddenly all of the elements of a problem integrate, we experience insight, which is essentially a closure process (see Fig. 7.18).

Fig. 7.18. Closure.

7.9.13 2. *Principles of separating.* These principles to a large extent are concurrent with grouping, since forming a unit implies separation from other material. Separation of units occurs in three important ways: first, through discrimination of visual elements distributed on a plane, as in a mosaic.

7.9.14 Second, through distribution of material away from or toward the viewer, the problem of depth perception, an effect produced by visual cues. The perception of depth may be produced by the actual extension of material as in a display, or the cues may be simulated to produce apparent depth, as in a photograph.

7.9.15 Third, separation of units may be accomplished through a distribution through time. Sometimes, however, even striking changes in shape over a period of time do not produce a new unit. Watching a flower open in slow-motion photography reveals that there is a great deal of change in shape, although the unit, the flower, retains a recognizable form.

7.9.16 In other instances, the unit over a period of time may be changed without changing its essential shape. This is the problem of imbedded figures which was previously illustrated with the map of the Mediterranean Sea. It is the first of two types of separations involving space rather than time which we will discuss here.

7.9.17 a. *Contrast.* Probably the most fundamental technique for producing a reliable segregation of material is through the juxtaposition of opposing elements. Most of us are familiar with the fact that black next to white makes the black seem blacker and the white seem whiter. The same effect can be produced by placing complementary colors next to each other. Generally when differences between two elements are perceived, the differences appear to be greater than they are measurably.

7.9.18 In all forms of communication we tend to make use of contrast. We tend to speak of "true or false" and "weak or strong." The best way to produce the appearance of smallness of an element is to place it in the neighborhood of larger ones. (See Fig. 7.19.)

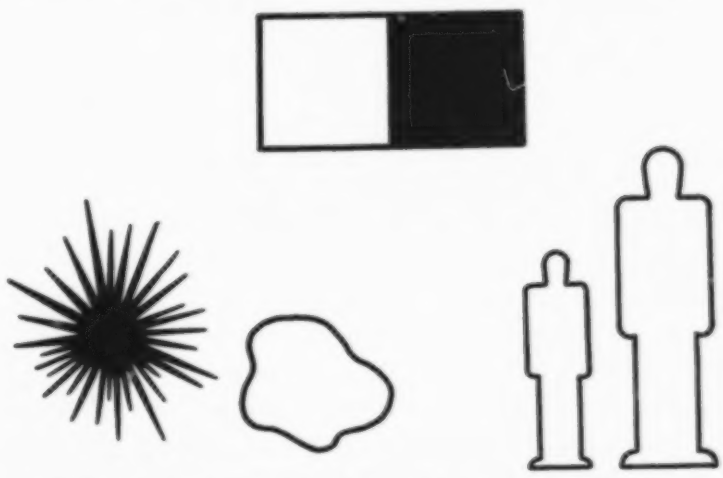


Fig. 7.19. Contrast: shape, brightness, and size.

7.9.19 b. *Figure-ground.* Rubins was one of the first to emphasize the fact that in perception there is a strong tendency to divide the visual field into two distinct areas: a focal area which is clearly articulated as the *figure* and usually lies closest to the observer, and the rest of the field, which forms into a relatively vague *ground* for the figure. Rubins' demonstration figures have become familiar to most of us, and a variation of one is shown in Fig. 7.20.

Fig. 7.20. Reversible image.

7.9.20 Generally, if possible, complex two-dimensional designs are resolved into simpler three-dimensional ones. If at any moment the visual field is actually perceived as flat and two-dimensional even the most familiar scenes would become unrecognizably incoherent. This is simply illustrated by the Necker Cube (Fig. 7.21), which can be most readily comprehended as a three-dimensional cube and is almost impossible to see as a flat, two-dimensional design.

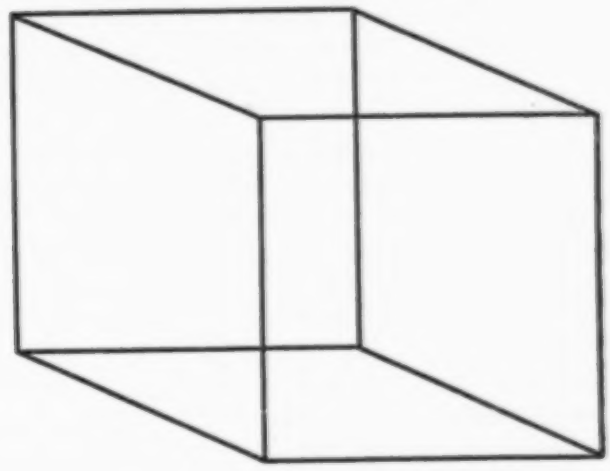


Fig. 7.21. The reversible Necker Cube.

7.9.21 c. *Depth cues.* There are a number of cues in the environment which we have learned to interpret as indications of depth. Whenever extension in space is perceived, one or more of the following principles is at work:

7.9.22 *Overlap.* This principle, sometimes called interposition or superposition, refers to the fact that objects which cover other objects are seen as closer. The technique of producing depth by overlap comes late in the development of drawing by children. In early art work and in many primitive societies there is a tendency to attempt to reveal all elements. The rather simple technique of overlap is probably the simplest and most frequent cue in sensing depth (Fig. 7.22).

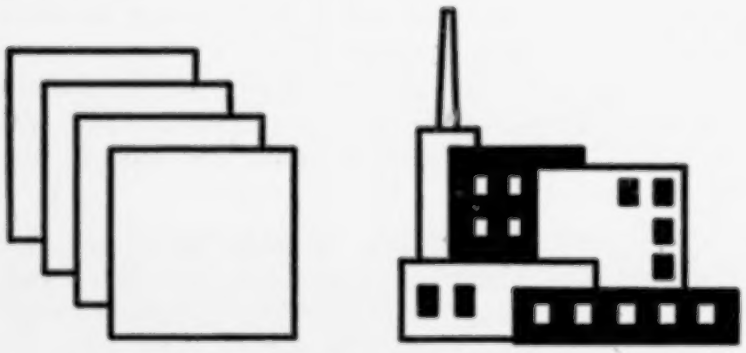


Fig. 7.22. Overlap.

7.9.23 *Size perspective.* In general, of two unknown objects of unequal size at the same distance, the larger one appears closer. Many of us have experienced the illusion of underestimating the distance of a mountain. In Fig. 7.23, it is difficult to determine which of the circles is at the same distance as the head because distance is difficult to determine if the object is ambiguous and its size unknown.

Fig. 7.23. Size perspective.

7.9.24 *Linear perspective.* Whenever we look down a railway track, we experience depth largely owing to the convergence of the tracks to a point on the horizon. At any given moment the visual field contains many slanting lines which resolve into meaningful perspective. The mere slanting of lines, however, is not usually sufficient to produce the experience of depth (see Fig. 7.24).

Fig. 7.24. Linear perspective.

7.9.25 *Aerial perspective.* The effect of a receding gradient is familiar to anyone who has viewed the changing texture in the color of sand at a distance. In general, close objects are highly textured and brighter in color and far objects are smoother and less chromatic, tending toward neutral gray, as suggested in Fig. 7.25.

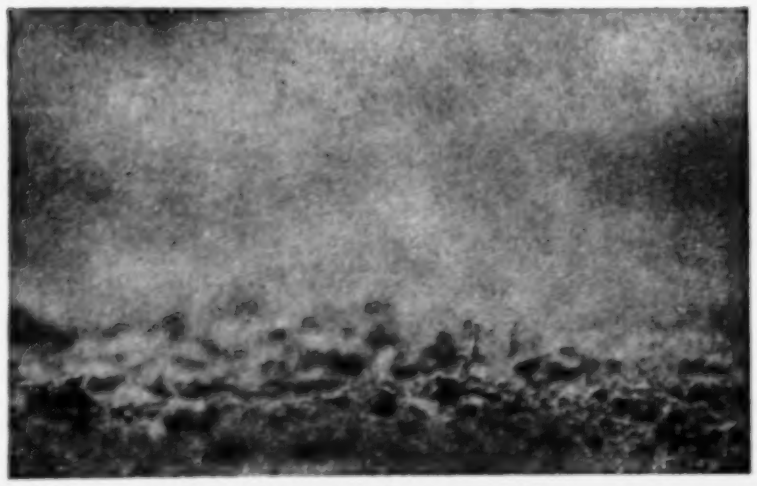


Fig. 7.25. Aerial perspective.

7.9.26 *Light and shade.* Depth and direction of an element can be frequently determined by the areas of light and shadow. It is largely because we are so accustomed to having a light source from above, from the sun or ceiling lamps, that we interpret an element as protruding if it has a shadow in the lower area and receding if the shadow is in the upper area, as seen in Fig. 7.26.

7.9.27 *Filled space.* In general, a distance which is filled by elements appears longer than empty distance. The distance to the horizon,

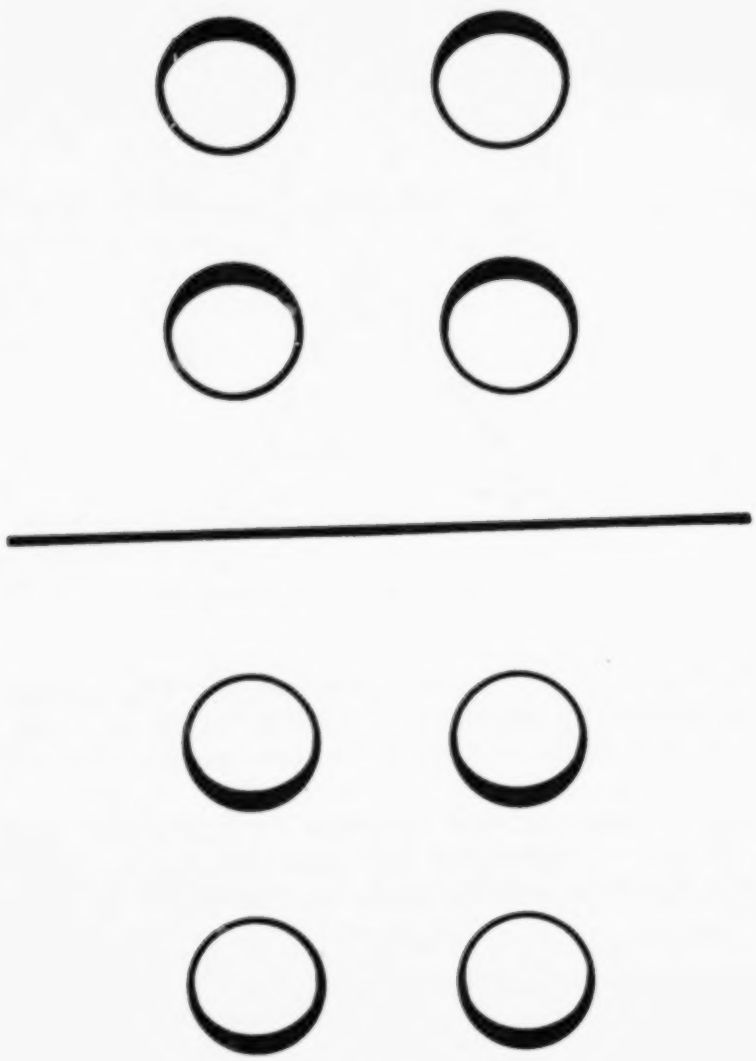


Fig. 7.26. Light and shade.

for example, appears greater than the distance to the vault in the sky, largely because of the numerous elements between us and the horizon. Fig. 7.27 illustrates this point.

Fig. 7.27. Filled and empty space (The distance between the terminal boats is equal).

7.9.28 *Parallax of movement.* Changes in the relationships between objects when the head is moved affords an excellent cue of depth. In general, the further the object, the more it appears to move with us. We are all familiar with the way the moon appears to follow us as we travel in a car or train. Parallax is not possible to demonstrate in a single picture. Fig. 7.28

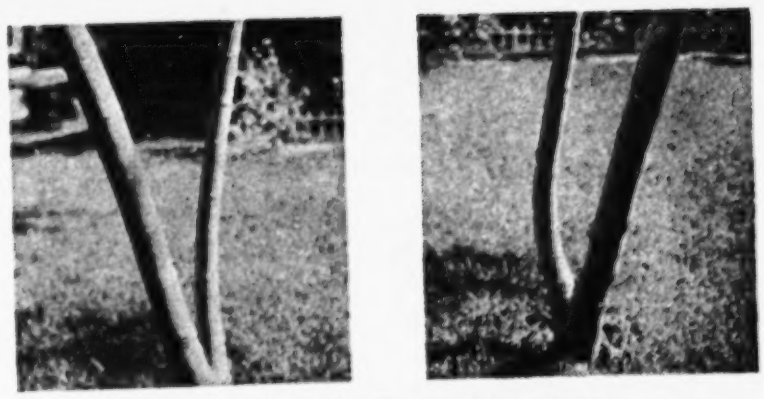


Fig. 7.28. Parallax of movement.

shows the changes, however, that occur in head movement.

7.9.29 *Moving objects.* The principle of moving objects in general is that faster moving objects seem to be closer. If all other cues are eliminated, a striking illusion can be produced. A silhouette of a fast-moving object passing behind a silhouette of a slower one will tend to appear closer.

7.9.30 *Fixation.* Objects which are fixated for any length of time appear to be closer than the other objects; therefore it follows that the elements of a picture or design that gain attention may appear larger than intended.

7.9.31 *Distortion.* Frequently at close distances, familiar objects become distorted through foreshortening. This effect is familiar to most of us in ultra-close-up portraits of persons, where a hand or nose may appear disproportionately large. Estimation of depth with this cue is good only within relatively short distances. However, it can be used as a dramatic statement, as in Fig. 7.29.

7.9.32 3. *Perceptual integration.* One can visualize at this point how perception develops from, diffusion to differentiation, from the above principles. From the initial "oceanic" perception of an object, various elements begin to stand out—segregate from the others and spontaneously form units in terms of grouping principles. Almost at the time of articulation, differentiation occurs, largely according to the relevant principles. The question now is how the transition is accomplished from the differentiation phase to the integration phase.

7.9.33 The following two principles are to a large extent "master" principles of perception in that they are concerned with the unification and coherency of the entire visual field. The problem is: how are perceived similarities and differences resolved into integrated perceptions?

Fig. 7.29. Distortion.

7.9.34 a. *Principle of "good figure."* One of the major formulations of a group of psychologists working in the area of perception concerning the nature and organization of forms is that of "good figure" which in simple terms states that as far as the conditions permit, every perception tends to be as complete, symmetrical, balanced, or as "good" as possible. A form is something over and above the elements which combine to produce it.

7.9.35 The implications of *Gestalt* psychology are concerned with this problem, and the formulated principles are highly pertinent to analogic or continuous coding because of the general emphasis on the whole over and beyond the elements comprising it. The term *Gestalt* is practically synonymous with the term *form*. The following fourteen basic characteristics of a good form are quoted from Boring's analysis. Because of the pervasive nature of good figure, many of the preceding principles will be involved.

7.9.36 *Naturalness of form.* A field tends to become organized and to take on form. Groups tend to form structures, and disconnected units to become connected.

7.9.37 *Figure and ground.* A form tends to be a figure set upon a ground, and the figure-ground dichotomy is fundamental to all perception. The simplest form is a figure of undifferentiated quality set upon a ground.

7.9.38 *Articulation.* Forms vary from simple to complex in the degree of articulation or differentiation that they possess.

7.9.39 *Good and poor forms.* A good form is well articulated and as such tends to impress itself upon the observer, to persist and to recur. A circle is a good form.

7.9.40 *Strong and weak forms.* A strong form coheres and resists disintegration by analysis into parts or by fusion with another form.

7.9.41 *Open and closed forms.* An open form tends to change toward a certain good form. When a form has assumed stable equilibrium, it has achieved closure. Thus a nearly circular series of dots may achieve closure by being perceived as a circle.

7.9.42 *Dynamic basis of form.* A form is a dynamic system or is based upon a dynamic system. Since the dynamic principles operate within the organism, a strong form is that which depends more upon the dynamic properties of the organism than upon the properties of the stimulus.

7.9.43 *Persistence of form.* A form once perceived tends to persist, and to recur when the stimulus situation recurs. The recurrence of part of a previously perceived form tends to reinstate the whole.

7.9.44 *Constancy of form.* A form tends to preserve its proper shape, size, and color.

7.9.45 *Symmetry of form.* A form tends toward symmetry, balance and proportion. Many of the geometrical 'illusions' illustrate this principle.

7.9.46 *Integration of similars and adjacents.* Units similar in size, shape and color tend to combine to make better articulated forms. Near units also combine more readily than far.

7.9.47 *Meaningfulness of forms.* A form tends to be meaningful and to have objectivity. The more meaningful the form, the stronger it is, the more easily it is perceived, and the longer it tends to persist.

7.9.48 *Fusion of forms.* Two forms can fuse, giving rise to a new form; or, in combination, the stronger one may persist, eliminating the weaker. Simple, poorly-articulated forms fuse more easily than the complex, good forms. A more

meaningful form tends to predominate over a less meaningful one.

7.9.49 *Transposition of form.* A form exists independently of its constituent elements and may thus be transposed without change to other elements.

7.9.50 b. *Principle of perceptual constancy.* This principle is sufficiently important to require further elaboration. Essentially, this principle states that differences in size, movement, color, etc., between complements tend to be perceptually reduced. The tendency is to recognize an object as being the same regardless of the angle we see it from, its distance from us, and its general surroundings.

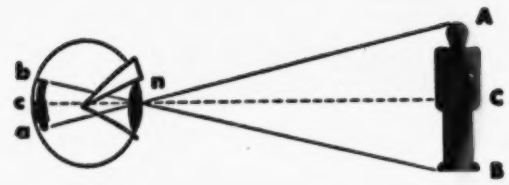
7.9.51 To a large extent the world of personal perception would be confusing, to say the least, if objects in it did not remain reliable and predictable under all sorts of conditions. Imagine the wild dance that must occur on the retina of an outfielder as he runs catching quick glimpses of a fly ball. Yet, what he sees is the ball coming in on a well-ordered course.

7.9.52 We still see paper as being white under a strong moon as we do under sunlight, even though the paper by moonlight is 500,000 times darker. Actually, if we could set up an experiment where we can see under sunlight the sheet of paper, but with the same brightness it has under moonlight, we would describe it as very dark gray tending toward black.

7.9.53 Similarly, with size, as a person approaches or walks away from us, although the retinal image shows a corresponding increase or decrease, we tend to see the person as almost the same size—that is, his size, as in the case of the brightness of the paper, remains fairly constant.

7.9.54 This can be demonstrated in terms of a simple experiment and with the help of simple geometry. If we place an object of known size at various distances from a subject, it is possible to compute the size of the object on the retina at each distance, as shown in Fig. 7.30.

7.9.55 4. *Optical illusions.* The study of optical illusions provides extremely important clues about perception. The fact that we cannot directly perceive space but must infer it from cues suggests that all space perception is illusionary. However, illusions are ordinarily restricted to a class of perceptions that contain estimates and evaluations which do not correspond with either measurement or critical observation of the



$$\frac{\text{Size of the physical object}}{\text{Size of the retinal object}} = \frac{\text{Distance of the physical object from the lens}}{\text{Distance of the retinal object from the lens}}$$

$$\frac{AB}{ab} = \frac{Cn}{cn}$$

Fig. 7.30. The size of the image on the retina.

stimulus. A number of these illusions can be profitably explored.

7.9.56 An early discovery made by Oppel was that the distance between two terminal dots containing a series of dots appears greater than if there were no intermediate dots (see Fig. 7.27).

7.9.57 Another illusion introduced by Helmholtz and known as Helmholtz's squares showed that rows of horizontal lines produce the effect of being tall and thin while columns of vertical lines are perceived as short and wide, even though both series of lines are contained within the area of identical squares (Fig. 7.31).

7.9.58 Wundt, in a relatively simple design, showed that there is a perceptual tendency

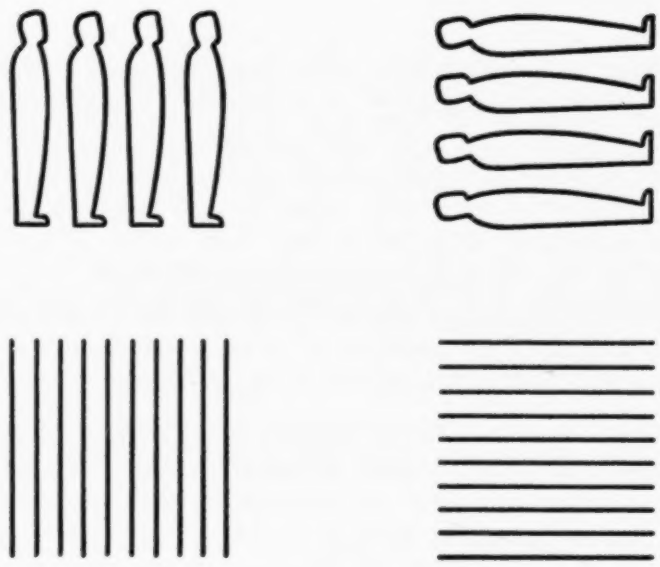


Fig. 7.31. Helmholtz's squares.

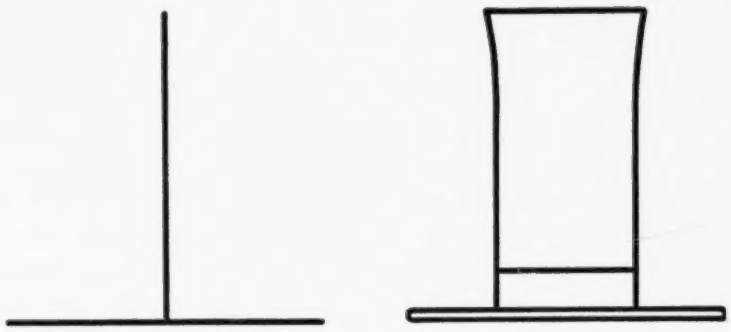


Fig. 7.32. Wundt's vertical and horizontal.

to overestimate the vertical over the horizontal, as shown in Fig. 7.32.

7.9.59 The Poggendorff Figure, as it has come to be called, is in an interesting "exception" to the principle of good continuity.

7.9.60 Probably one of the most dramatic illusions is that of Hering's or Wundt's, in which perfectly straight lines are perceived as curves, as shown in Fig. 7.33.

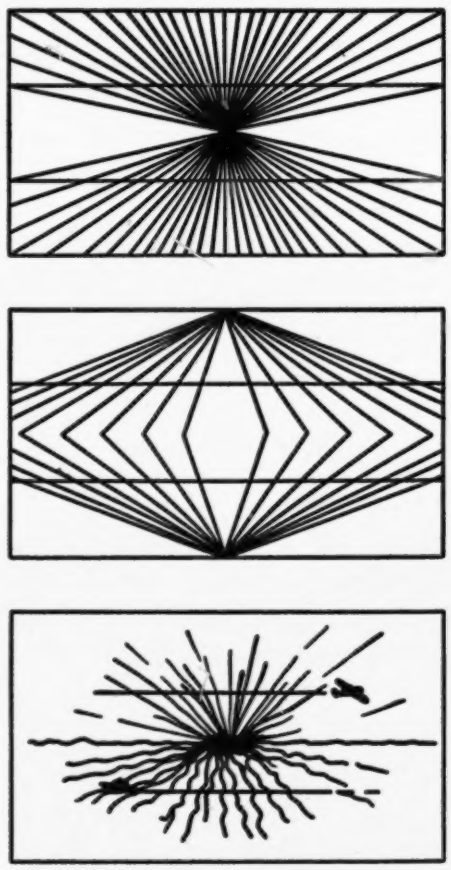


Fig. 7.33. Hering's (top and bottom) and Wundt's figures.

7.9.61 The most popular illusion, however, is the Müller-Lyer illusion. One of the two equal lines in Fig. 7.34 appears strikingly smaller

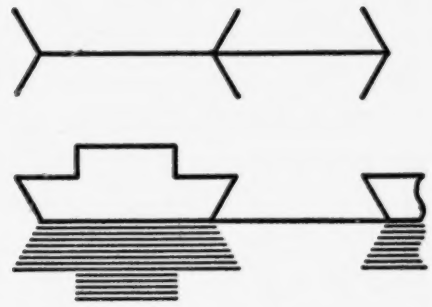


Fig. 7.34. The Müller-Lyer illusion.

than the other. If the wings of the lines are reversed rapidly in the position shown above, an illusion of motion is seen.

7.9.62 Another interesting type of illusion is provided by the reversible figure and ground (Fig. 7.20) where one can see either two profiles or a vase, depending upon which area is seen as figure and which as ground; similarly, the Necker Cube (Fig. 7.21) also has reversible perspective.

7.9.63 In recent years there has been a great deal of concern with illusions of space, size and distance, which show the extremely unique and personal nature of a perceptual transaction. A good example is provided by a view of the distorted room of Ames, shown in Fig. 7.35. Although the room appears normal, the sizes of the heads are inconsistent. The two appear to be equally distant and the size of windows the same, but actually, as indicated in the plain view of the room below, the room is distorted so as to produce the illusion.

7.9.64 5. *The perception of movement.* Movement is seen when the displacement of an object can be perceived by the eye — for example, a moving car, or when the relationship between two objects changes, as in the hands of a clock. Both types of motion can be either real or apparent. The two frequently interact.

7.9.65 Movies are based upon apparent motion. The succession of stills at a particular rate produces the effect of actual movement. If two light bulbs are lit in succession at a certain rate, the appearance is not of two blinking lights, but a smooth movement from one to the other. All sorts of unusual movement affects can be produced with several lights. The source of the moving light, for example, seems to start with the brightest light — even if the brightest light is not the first to light.

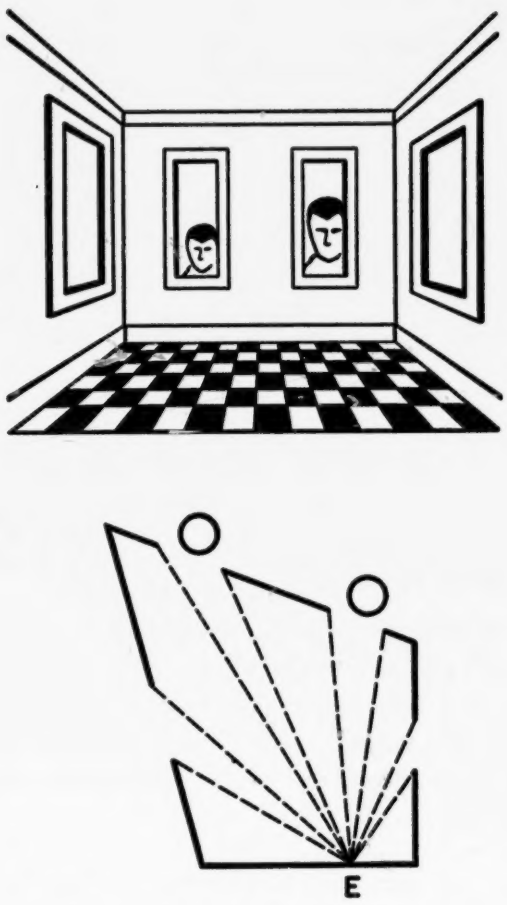


Fig. 7.35. The Ames' distorted room (from Bartley, S. H., *Principles of Perception*. Harper and Brothers, 1958).

7.9.66 Everyone is familiar with the illusion of the moon sailing through the sky. This is due to a basic principle of relative movement, which holds that object, even if stationary, appears to move when there is a gradual displacement of position relative to the larger environment containing the object. That is why the moon, rather than the clouds perceived as part of the surroundings, seems to move, and also, why we sometimes feel that we are moving in a train when actually the adjacent train, which appears stationary, moves. In this last instance, we are the object and the actual moving train is the surrounding environment.

7.10 Functional Characteristics

7.10.1 Thus far we have been discussing the structural qualities of perception. In this section, the concern will be with the purposes and functions which perception serves. To a large extent, any of the structural variations of perception can be understood in terms of the functional needs of the observer. There are several important areas that require consideration:

7.11 Variability of Perception

7.11.1 One striking characteristic in examining the perceptions of a group of individuals is the degree of variation in terms of their perceptual judgments and estimates. By way of a general principle, the more ambiguous the configuration, the more variable the responses. This is substantially the basis of projective techniques, such as the familiar inkblot test (Fig. 7.36), which utilizes ambiguous patterns to elicit different perceptions. Usually, the interpretation of ambiguous stimuli can be used to determine the needs of the observer. A more familiar example of projection with ambiguous material is the seeing of objects in cloud formations.

7.11.2 Several interesting psychological experiments will clarify this point. In a study by Sherif, subjects were shown a pinpoint of light in a darkened room. Even though the light remained stationary under these conditions, an illusion of movement was seen. By asking subjects to estimate the distance traversed by the point of light, a great deal of variability was obtained. Some subjects barely saw any movement, while others estimated movement of many feet.

7.12 Motivation and Set

7.12.1 In a subsequent part of the experiment by Sherif, mentioned above, subjects

Fig. 7.36. An inkblot (what does it look like?).

were allowed to view each others' estimations of the distance travelled by the point of light. As might be expected, there was a strong tendency for those who had large estimates to reduce their estimates in subsequent observations and for those with smaller estimates to increase them. Sherif interpreted this as the effect of the group on the individual, or the motive of conformity.

7.12.2 The effects of this motivation were also shown in an experiment by Asch. Rather than using illusionary movement, comparative estimation of line size was used. Subjects were asked to judge which of two lines was larger. In every instance, this would have been an easy matter, except for the introduction of a new motivating force. One subject at a time was placed in a group that had (unknown to him) been instructed to report after every two or three evaluations that the objectively larger line was smaller.

7.12.3 Before the "naive" subject was allowed to answer, the other subjects indicated their judgments. As many as one third of the experimental, or "naive" subjects conformed to the group evaluation — that is, they estimated a clearly larger line to be smaller. Many of us are familiar with the inconsistent reports made by eyewitnesses at the scene of an accident, owing to different motives and set.

7.12.4 Another interesting experiment was performed by Bruner and Goodman. Children were asked to estimate the sizes of various coins, by manually adjusting a diaphragm until it seemed to be the same size as the presented coin. In general, there was a tendency for overestimation to increase with the value of the coin. Also, poorer children tended to overestimate the size of the coins more frequently than did the richer children, for apparent reasons.

7.12.5 Set operates to a large extent in our everyday life in shaping our perceptions. Hunters often interpret a vague movement in the bush as being a deer, and may shoot a cow.

7.12.6 An interesting investigation of rumor was made by Allport and Postman: a picture of an emotionally charged scene, such as a white man brandishing a straight razor at a Negro, was shown to a subject, who was then told to describe the picture to a second subject, and the second subject to repeat it to a third subject, etc. The final subject usually relates a description of the scene which is highly modified, in three significant ways: First, many of the elements became *sharpened.* For example, in one experiment, a scene set in a subway includes a small sign saying, "Elect McGinnis for Alderman." In one of the final descriptions of the picture, the scene was described as a political rally, with individuals screaming for the election of certain individuals to office. Another type of modification is *levelling,* or the elimination of major and minor elements, as in the above, for example, where the subway was lost in the relaying of the rumor. Finally, *assimilation,* or the introduction of altogether new and personal elements into the description, may take place. Fig. 7.37 shows a pictorial rumor relay.

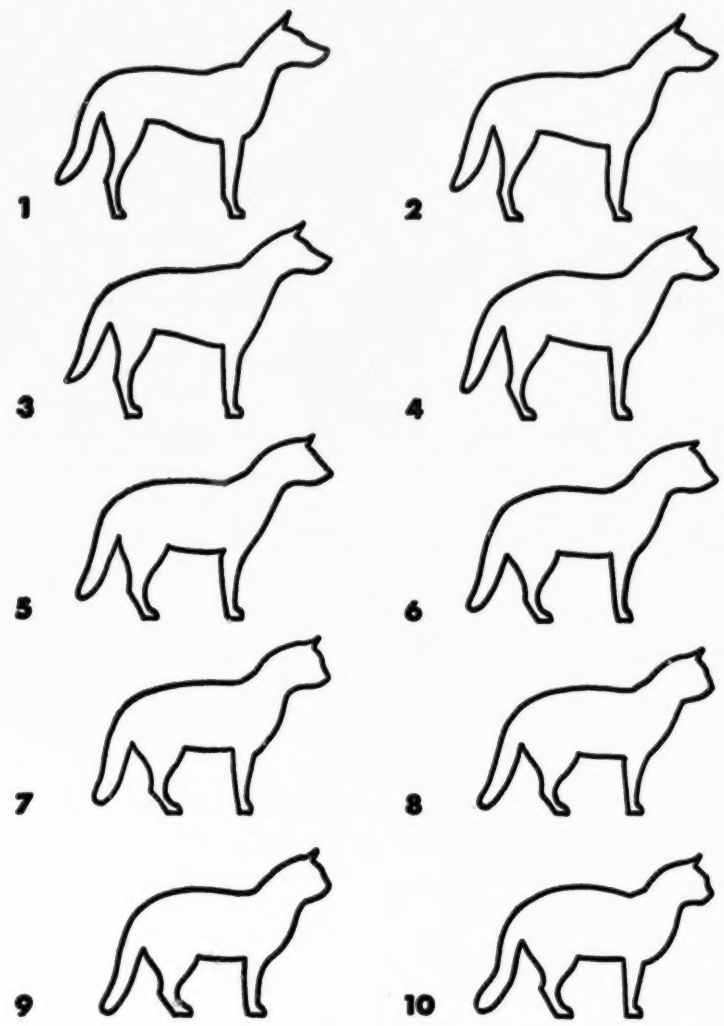


Fig. 7.37. A pictorial rumor.

7.13 Meaning and Learning

7.13.1 The meaning obtained from a visual communication is largely due to previous experience. A symbol written in Chinese is incomprehensible to a person unfamiliar with that language. Many individuals have not learned how to perceive significance from abstract geometric forms. These individuals, if asked to reproduce such forms, will alter them to concrete, familiar objects, as shown in Fig. 7.38.

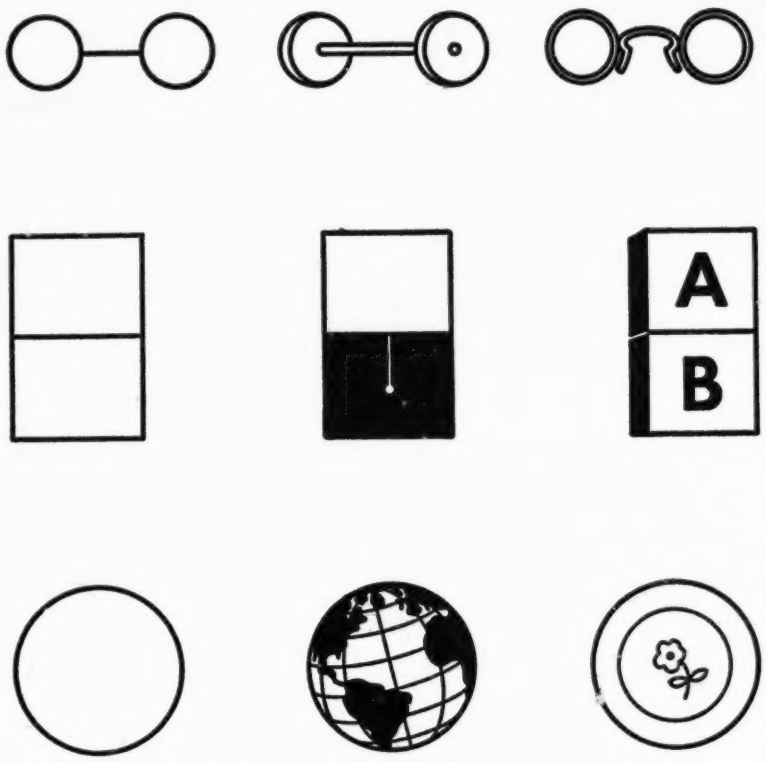


Fig. 7.38. Interpretations of simple geometric forms.

7.13.2 Meaning is substantially based on organization and relationships. In verbal language, the syntax, or the relationship between words and the structure of the sentence, largely determines the degree of effective communication. With visual communication, there is no standardized set of rules comparable to verbal syntax. To a large extent, the general principles of structural organization in a visual perception provides a step in the direction of a non-verbal syntax.

7.13.3 The problems involved in *codifying* nonverbal communication are far greater than for verbal communication. Ruesch and Kees have pointed out an important distinction between these two forms of communication. The authors called verbal language, including mathematics, *digital coding*, because the elements which compose the communications are complete; also, they bear no direct relationship to the objects being symbolized. For example, the letters C-A-T are discrete elements and bear no resemblance to the familiar animal.

7.13.4 In nonverbal forms of communication, including pictures, gestures, and the dance, *analogic coding* is involved. The term "analogic" implies that there is a resemblance between the symbol and the object symbolized, and that the symbol is continuous — that is, composed of uninterrupted elements. Because of its highly spatial nature, and the fact that the elements are so highly influenced by the nature of the whole, the difficulties of devising a logical code seem almost insurmountable.

7.13.5 There are several important varieties of analogic codification, which bear different types and degrees of relationships. The most realistic in terms of visual perception are *icons*, which include photographs and other realistic representations. When the relation between symbols and object is intellectual in nature, such as a blueprint, map, plan drawing, or a graph, the symbol is *schematic*. *Emotional representation*, one of the least investigated forms of nonverbal communication, is found in the color and design *abstractions* of many contemporary artists. Walt Disney, for example, uses this type of representation in the visualization of Bach's Toccata and Fugue in "Fantasia."

7.14 Personal Functions

7.14.1 There are in general three basic principles concerning personal appeal of visual perception. Of the many hundreds of principles of aesthetics formulated by philosophers, artists, and designers, these tend to fall into three clusters, and each cluster bears a strong relationship to a personality need:

7.14.2 1. *Equilibrium.* Most of the ideas concerning attractive perception fall into this category, sometimes called *homeostasis*, or balance. This refers to the degree of proportionate distribution of material, and stability, either static or in movement. The balance may be symmetrical or asymmetrical, provided there is perceived equilibrium of over-all distribution. This appeal is significantly related to the need of the personality for equilibrium (as well as that of the body). Some of the design principles which seem to be involved in this personal function are balance, proportion, symmetry, apposition, and repose.

7.14.3 2. *Development.* The second group of visual ideas seems to cluster around the personal need for development, variation, and growth. In an effective visual presentation the treatment of the principal theme is successfully developed. This is accomplished through various means, usually involving simplification of treatment, a good distribution of major and minor elements, and a rhythmical patterning. Some of the design principles involved here include rhythm, dominance, repetition, variety sequence, contrast, scale, gradation, emphasis, subordination, transition, climax, conflict, expansion, re-

currence, accent, theme and variation, concentration and continuity.

7.14.4 3. *Adjustment.* The third group of aesthetic principles seems to relate to the notion of integration, adjustment, and harmony. The various elements are blended into a pleasing whole. Noteworthy principles here are harmony, unity, order, fitness, form, cohesion, relation, congruity, consistency, inclusion, finality, simplicity, restraint, and impartiality.

7.15 The Uses of Visual Communication

7.15.1 A visual perception intended for visual communication can be treated in one or more of five fundamental ways. These purposes to a large extent have to do with the communicator's intent, for each can communicate the same content or ideas, but in different form, and usually with different consequences.

7.15.2 1. *Identification.* The most familiar technique of presentation is to show the key identifying marks of a particular product. These marks may include the object's container, the symbols that represent it, like trademarks, its place of origin, or time of development, the object itself, or the various forms it assumes. Frequently the identification of an object seems to suggest that it is reliable. Among the many ways of producing an atmosphere of confidence for a product are to give it a brand name, imprint the name of the place where produced, or imprint the date produced. Fig. 7.39 shows milk with several of its identifying marks.

7.15.3 2. *Characterization.* At times, a visual presentation is shown in terms of its ingredients or characteristics by means of a close-up showing small details and the fine texture or through an analytic breakdown. The characterization may be either with or without object identification. The latter may arouse interest because the incomplete or partially shown object

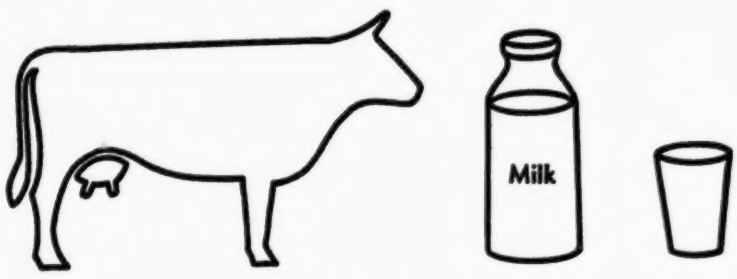


Fig. 7.39. Identification.

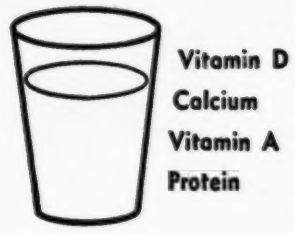


Fig. 7.40. Characterization.

Fig. 7.41. Evaluation.

requires a solution. In Fig. 7.40, milk is both identified and shown with its ingredients.

7.15.4 3. *Evaluation.* When the purpose is to evoke various degrees of favorable or unfavorable feelings about an object, the communication will contain evaluative symbols. The object will be cloaked accordingly with angelic or satanic garb. The evaluational elements of a visual communication are usually handled through color, shape, general appearance, angle of view, or demonstration of consequences. The delight obtained from consuming a glass of milk is illustrated in Fig. 7.41.

7.15.5 4. *Prescription.* Another intent may be to prescribe or suggest a course of action,

Fig. 7.42. Prescription.

sometimes simply portrayed by an arrow. Prescriptive symbols attempt to modify behavior, attitudes, or the perception of an object. During World War II, most of us can recall large posters of Uncle Sam pointing his finger at the hypothetical observer, with the caption, "I want you." A simple prescriptive technique is used in Fig. 7.42.

7.15.6 5. *Relating.* Whenever it is desirable to go beyond the object itself for purposes of comparing it with other objects so as to provide a relative frame of reference, some tech-

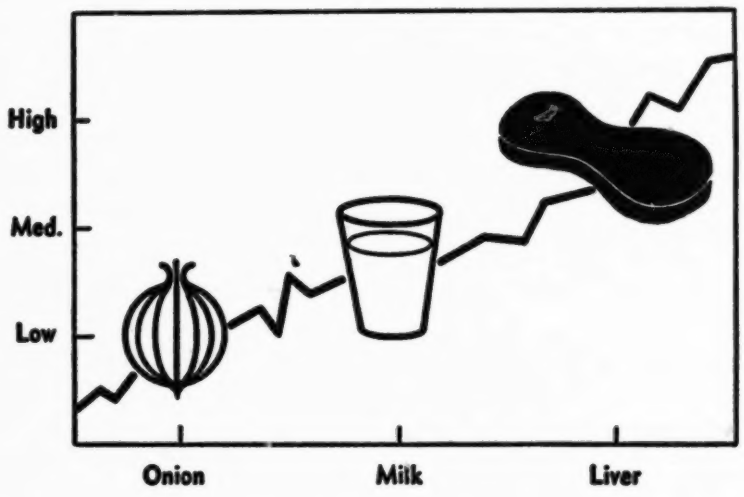


Fig. 7.43. Relation.

niques permitting relating are used. These may include graphs, charts, figures, tables, or simply presenting an object with other objects. Fig. 7.43, for example, shows the relationship between milk and other food products in terms of (nutritional or caloric) values.

7.16 Summary

7.16.1 Visual perception provides a firm foundation for understanding the nature of visual communication. A knowledge about the visual field including the characteristics of visual sensations, modulation, and discriminations is pertinent background material for understanding the nature of visual communication, which in turn involves an understanding of both the structural and the function properties of perceptual development.

7.16.2 Structuring of visual material occurs when sensations are grouped in terms of proximity, similarity, common movement, common destiny, and closure, and separated by means of contrast, figure-ground, and depth cues. Finally, the principles of good figure and constancy suggest a means by which the entire visual configuration is integrated into a single coherent whole.

7.16.3 Thus, in viewing an object, there is the transition from the initial confusing "oceanic" or diffusion phase to the analytical or differentiation phase, and finally to the internally integrated stage of development. Relevant functional characteristics generally include an understanding of the variability or individual differences found in perception, the role of motivation and set, and meaning — and specifically, the knowledge of the unique personal bases underlying the attractiveness of a visual, which include the perception of equilibrium or balance, development and adjustment or integration.

This, then, provides the foundation upon which abilities to perform various necessary tasks and successful visual communications are based.

8. Some Other Theories of Perception

prepared by Martin Krampen

8.1 Range of Present Theories

8.11 In the preceding chapter, one theory of perception has been developed in some detail. In a later chapter, these principles and concepts will be applied to specific and concrete situations. There are other theories of perception. The basis of the theory may be formal, that is, concerned with the built-in physiological or neurophysiological equipment of perception, or functional, that is, concerned with the motivational factors in perception.

8.12 This chapter presents an abbreviated version of 11 other theories to provide a condensed panorama of present perceptual theories. The theories included are:

1. Cell-assembly theory
2. Sensory-tonic perception theory
3. "Set" theory
4. Cybernetic theory
5. Adaptation-level theory
6. Probabilistic theory
7. Transactional theory
8. Motivation theory
9. Hypothesis theory
10. Topological theory
11. Learning theories and perception.

8.13 Some literature for each of these theories is included for further investigation, or the reader may wish to refer to the summaries of these and other theories by Allport, Bartley, and Bakan.[1]

8.2 Cell-Assembly Theory

8.21 When we perceive an object a large number of nerve cells in the central nervous system are activated. Whereas the perception of the unity of a figure against its background seems to depend on an innate mechanism, the perception of the identity of this figure must be gradually acquired, that is, "learned." This "learning" takes place when the individual explores the figure by means of many separate fixations of its parts. One fixation is connected to the other by eye movement. The perception of identity is thus an unconscious additive reconstruction of the figure by many rapid fixations.

8.22 With each fixation, a group of nerve cells is excited. A simple percept corresponds to a simple cell assembly. The cells of such an assembly facilitate each other: over time their mutual contact becomes closer and closer; they "grow together" by repeated "usage." More complex percepts correspond to compounds of interfacilitated cell assemblies. According to this concept, the perception of a triangle would consist of the following phases:

8.23 The fixation of angle A brings about cell assembly a. This assembly incorporates motor neurons which cause the eye to shift from angle A to B (or C). The shift results in assembly b (or c). The shifting from angle to angle is called a phase sequence. There need not be any regularity in phase sequences. Typical sequences may be a-c-b-a-a-c-a-a-b-c-a, etc. Phase sequences involving over time more and more new cells and exhibiting more and more facilitation, build up a compound system, called assembly "t." "t" is an interfacilitated group of cell assemblies corresponding to the perception of the triangle as a whole. Finally the perception of identity has been acquired. t does not replace the assemblies, a, b, and c. It intervenes in a phase sentence, e.g., in the following manner: a-c-t-a-b-t-a-t-c, etc. This means that perception of the whole alternates constantly with perception of the parts.

8.24 By means of this logical system many perceptual concepts can be convincingly explained, e.g., *"closure,"* in the case of a triangle which is presented open at angle C, corresponds

[1] Floyd H. Allport, *Theories of Perception and the Concept of Structure.* John Wiley & Sons, Inc., New York, 1955. S. Howard Bartley, *Principles of Perception,* Harper and Brothers, New York, 1958. Paul Bakan, "Current Theoretical Approaches to Perception." In: *Present Day Psychology,* A. A. Roback, ed., Philosophical Library, New York, 1955.

to an activation of t facilitated by a and b. *Learning* can be explained as a lasting change of facilitation among specific cell assemblies. Learning builds up slowly. The environment controls the activity of the nerve cells in the brain and re-establishes in trial after trial the same group of cell assemblies. Finally this results in ready-made cell patterns which are connected by motor activity (as we saw in the case of phase sequences).

8.25 *Attention* may be viewed as a facilitation of some perceptual mechanism in general by some central compound. If this facilitation occurs before the corresponding stimulus pattern is present, we may talk about *expectancy*. *Pleasure* can be interpreted as "easy" development of cell assemblies, *emotion* as a conflict of phase sequences, etc.

(For additional information, see: D. O. Hebb, *The Organization of Behavior*. Wiley & Sons, New York, 1949).

8.3 Sensory-Tonic Theory

8.31 Many perception theorists would agree today that the purely "sensory" approach to perception is insufficient. Changes in body posture, visceral and somatic muscular activity contribute as well as sensory processes to the perceptual end product. When a muscular reaction takes place *proprioceptive impulses*, originating from receptors in the muscles, are fired along different pathways to the sensory association areas in the cortex. There they interact with impulses originating in exteroceptors (eye, ear, skin, etc.), stemming from an external stimulus; this interaction may be understood as a gestalt-like whole: a percept is "sensory" and "tonic" as-a-whole. The sensory and tonic components of perception are "dynamically equivalent"; one can be functionally substituted for the other. The following experiment may illustrate this theory further:

8.32 The subject is asked to adjust a rod pivoted at its center into a vertical position. A control experiment is performed first in which the slight deviations of the rod from the geometrical vertical (a result of the subject's own perception of the vertical) are recorded. Then the experiment is repeated with an extraneous stimulus applied unilaterally. A tone may be fed into one ear or an electrical stimulus applied to one side of the neck. The additional stimulation increases unilaterally the muscular tension of the subject. This tension produces an additional "error" in the perception of the vertical, shifting it toward the side opposite to the one with increased muscular tension. Similarly, if the whole position of the subject is tilted over to one side, the vertical adjustment of the rod will be displaced in the direction opposite to the tilt. Displacement increases as the tilt of the body position increases.

8.33 These experiments show that the entire organismic state influences perception. If the stimuli do not disturb the organismic state, the perceived object is in balance with the given sensory-tonic equilibrium of the body. If the stimuli do interfere with the organismic state, the organism is activated to re-establish the equilibrium between body and object.

8.34 One way of accomplishing this is to "change the position of the object." If the neuro-muscular tonus on one side increases (by extraneous stimulation), counteractive tension is generated on the opposite side. The "horizon" rotates towards the latter side. The perceptual displacement is supposed to be equal to the sum of all stimulus vectors concurring in the situation, e.g., if the amount of vectors on one side (plus) outweighs the same amount of vectors on the other side (minus), the result is minimum displacement in perception.

8.35 The principle postulated here as the basis of perception is that of "minimal disturbance." Accordingly, the perceiving organism does not only "adjust" the position of the perceived object, if additionally stimulated, but has a general tendency to conserve symmetry and balance in the perceptual field. The sensory-tonic theory is an attempt to explain the features of perception according to this principle.

(For additional information, see: H. Werner and S. Wapner, "Toward a General Theory of Perception." *Psychological Review*, 59, pp. 325-338, 1952.)

8.4 "Set" Theory

8.41 Even more than the sensory-tonic theory, "set" theory of perception emphasizes the influence of the entire muscular background state on perception. "Set" in this physiological sense is not to be confused with the mathematical concept of set. "Being set" for a stimulus or for an entire reaction precedes actual perception. Each overt behavior may be seen as backed up by a set for it. Perception, as one form of behavior, is the integration of many kinds of incoming stimulation (from eyes, ear, skin, etc.) embedded in other overt behavioral processes.

8.42 A "set" has sensory and motor components. It is in fact a constantly ongoing process of neural and muscular events inside the

organism before and during its overt reaction. As such a process, set is not distinct from perception but a sub-threshold level of it. The lack of external stimulus support makes the set a less inclusive neuro-muscular pattern than the full percept. The entire organism is, however, ready to react or to perceive.

8.43 Besides the preparatory set of tonic nature, phasic contraction of muscles (that is, more intensive neuro-muscular patterns with overt manifestation) may also constitute part of the perceptual aggregate. Both the tonic and phasic levels of set operate in a closed circular manner: proprioceptive messages from the muscles are sent to the central nervous system; feedback and reinforcement are relayed back to the muscles. This cyclical process gives the set its aspect of continuity. The set does not only prepare a perceptual event but also sustains the continuity of perceptual activity.

8.44 The passage from a set to the attainment of a percept can be described in three phases:

1. Energy necessary for the final perceptual aggregate is built up by constant cyclical reinforcement.
2. Missing energy is supplied by external stimulation.
3. The sudden energy increase due to external stimulation brings about the above-threshold phase of perception.

8.45 If a set becomes fixed over time it may be triggered in different situations by stimuli which through some past percept had been related to it. On the other hand, since sets are merely sub-threshold states of full perceptual events, each set is specific to its percept. One set inhibits the operation of the other if both are antagonistic.

8.46 The set theory of perception explains thus physiologically the selectivity of perception, with regard to objects, the speed and readiness of perception, and within certain limits the content and vividness of the percept.

(For additional information, see G. L. Freeman, "The Problem of Set." *American Journal of Psychology* 52, 16-30, 1939; and *The Energetics of Human Behavior*. Cornell University Press, Ithaca, New York, 1948.)

8.5 Cybernetic Theory

8.51 The analogy between "electronic brains" and human brains has proved to lead to fruitful results in perception theory. In the terminology of "cybernetics," words like "information," "transformation," "scanning," etc., have been applied successfully in explaining neurophysiological data concerning perception.

8.52 One of the principal questions in perception is how a form is perceived invariably as that particular form although it changes constantly its position in space and its projection pattern on the retina. It has been found that the reflexes of the eye such as focusing of the lenses, convergence of the two eyes, and control of light volume by the iris contribute largely to this phenomenon. They bring and keep the object of attention, through their complicated interplay and their feedback connections with the central "computer," in a standard position on the retina such that the stimulation pattern varies within the smallest range possible.

8.53 Every reflex moves some input data through subsequent positions, intensities or other variables into a final position. This final value of the variable is called for by the constitution of the organism itself. The combined reflex mechanism of the eye cancels thus the casual and too specific aspects of the retinal image and selects from many possible positions a final one. This process has been defined as "reduction to the canonical position."

8.54 Electrical stimulation in specific areas of the human cortex have proved to elicit in the subject the experience of natural forms, such as a tree or a house, free from size or position in the visual field. These "universal" *images* "stored" in cortex areas with the function of visual memory seem to be the result of an averaging process over many particular images projected in a one-to-one fashion from the retina into the visual area of the brain. The retinal image, particular, although already brought into its "canonical position," is repeated as a pattern of excited nerve cells in the cortex and then compared with "average images." This relation is said to be the result of a cortical *scanning process*.

8.55 In television, through scanning by means of a rapidly travelling electronic beam, movement in space is picked up point-after-point and transformed into a sequence of signals. The same process is reversed at the receiving end. As the camera samples sets of transformations going on in the scene, it transmits them in sequential form which is then unfolded again on the receiving screen.

8.56 Some kind of a similar process seems to go on in perception. The transformations of the outer world are projected — even though

not completely parallel—into the visual cortex and sampled by scanning. After an averaging process (perhaps some kind of random projection into another cortex area) an "extract" of the original transformations is reconstructed. Thus images of objects and motions in the outer world are received and "understood." A particular brain wave, the alpha-rhythm, has been said to constitute an equivalent of the scanning beam in television.

8.57 The alpha-rhythm has a frequency of one-tenth of a second. This time interval is very important in perception since it seems to represent the smallest quantum of time experience we can have. The flow in time of events would be accordingly perceived in such "chunks" of psychological time. From this concept important consequences for visual communication can be developed. Proper "chunking" in the coding of visual messages may be seen as a basic condition of successful communication.

(For additional information, see W. Pitts, and W. S. McCulloch, "How We Know Universals: The Perception of Auditory and Visual Forms." *Bulletin of Mathematical Biophysics*, 9,127-147, 1947; Norbert Wiener, *Cybernetics*, Wiley and Sons, New York, 1948.)

8.6 Adaptation – Level Theory

8.61 The scientist can never measure perception directly. He has to rely on the reports of the experimental subject. The subject's report of magnitudes depends on his experience with magnitudes in general. Each individual acquires his own subjective frame of reference according to which magnitudes are judged. The organism establishes this frame of reference by bringing some kind of an order into the array of quantitative experiences.

8.62 Some region within this array assumes the function of a standard with reference to which the other stimuli are judged as smaller or larger, heavier or lighter, etc. This reference region is called the adaptation level. The whole structure of the perceived field is determined by the adaptation level of the subject. The adaptation level is in constant change since it is "a function of all the stimuli acting upon the organism at any given moment as well as in the past" (Helson). Stimuli of a magnitude close to the adaptation level are judged as "neutral" or "indifferent" by the subject. As stimuli occur above or below the adaptation level they are judged as of positive or negative magnitude.

8.63 The adaptation level is some kind of an average of the experience with magnitudes of a given dimension. This averaging process may occur below the threshold of consciousness and is of physiological as well as of psychological nature. Given a typical experiment, three different classes of stimuli are said to be pooled together in the subject's report: (1) Stimuli of the series which is presented in the experiment; (2) background stimuli, above or below the presented series; (3) residual stimulus effects brought into the experimental situation.

8.64 These different types of stimuli act according to their frequency, proximity, and other characteristics. If we assign correct weights to each of these stimuli, we can compute an average for a given individual in a given experimental setting. Knowing this average (adaptation level) we may predict his judgment of stimuli of a certain class. Thus the concepts of pooling, average, and adaptation level allow for a quantitative theory of perception and for a definition of perceptual processes in terms of mathematical operation.

8.65 The presence of an adaptation level in color vision has been shown: A stimulus appears achromatic depending on the average amount of reflected color illumination and background brightness. Below this "neutral" level the illuminated object can reverse its hue (as compared to the hue above the neutral level).

8.66 An adaptation level also seems to be present in social perception. The influence of social stimulation exerted on the perception of an individual depends on the size of the group. There seems to be a tendency towards an average accepted level of behavior for members of a social group and within the frame of the group's activities.

(For additional information, see: H. Helson, "Adaptation-level as Frame of Reference for Prediction of Psychophysical Data." *American Journal of Psychology* LX-1-29; and "Adaptation-level as a Basis for a Quantitative Theory of Frames of Reference." *Psychol. Rev.* 55, 297-313.)

8.7 Probabilistic Theory

8.71 The attainment of reliable perception of the world is an important prerequisite for the organism's successful adjustment to its surroundings. One stabilizing factor in perception is "constancy." Perceptual constancy seems to be a compromise between the always constant physical features of the object and its always changing features in the retinal image, given by always changing conditions. The result of this compromise is

the perception of an "intermediate object." On the basis of all available data the organism tries to extrapolate the object as reliably as possible, in order to meet the necessities of biological adaptation to the physical world. Cues from the object (brightness, color, etc.) and processes within the organism (convergence, accommodation of the eye, etc.) make for the relative validity of the percept.

8.72 Of course, the perception of the object can never be completely sure; it has only a *probabilistic achievement.* If many cues are available the organism averages their respective probabilities in order to assure the most accurate experience of the object. All the cues are, so to speak, ranked in terms of their reliability, and the weighted result is the perception of the object's dimensions.

8.73 In this perceptual operation the organism relies more on distal cues than on the proximal (retinal) image. The retinal image, however, provides necessary information for the constancy judgment. Its contribution for the attainment of size-constancy can be estimated in ratios as compared to the contribution of the cues. Sometimes the retinal image is more reliable than object cues; on the basis of experience the organism develops distrust for certain cues. Thus a system of more or less general "implicit hypotheses" about the value of cues and the retinal image dominates perception. Their varying degrees of subjective certainty bring about the final compromise of the percept.

8.74 Since this theory of probabilistic functionalism in perception is basically object-oriented, its methodology is object- and environment-oriented. The organism is considered as a whole; neurophysiological questions are not considered the proper object of psychological study. As the organism operates on a probabilistic basis, statistics are considered to be an appropriate form for making statements about behavior.

(For additional data, see: E. Brunswik, "Organismic Achievement and Environmental Probability." *Psychol. Rev.* 50, 255-272, 1943; and "The Conceptual Framework of Psychology." *Int. Encycl. Unif. Sci.* Vol. I, Part 2, University of Chicago Press, 1950.)

8.8 Transactional Theory

8.81 Perception is not only a passive weighting of probabilities attached to object cues but a dynamic transaction between organism and environment. Perception, purpose and action are functionally related in the organism's dealing with its surrounding.

8.82 Many ideas of transactional functionalism have been developed by using non-veridical perceptual experience in order to shed light on the normal veridical process of perception. One of the most efficient methods to elicit non-veridical perception is foreshortening, which has been used in many of the Ames demonstrations (chair, distorted room, trapezoidal window). Some non-veridical perceptions rest upon the fact that the same pattern of retinal stimulation may occur for different objects. Different stimulus configurations can be arranged which all will produce the same projection on the retina. How does the subject decide whether the percept is veridical with respect to one of the possible stimulus configurations?

8.83 On the basis of its past experience the subject makes assumptions as to the most probable origin of the stimulus pattern. The situation which in the past has been more often related with a given retinal stimulation, is assumed to apply also in the present occasion. Assumptions, whether they be true or false, constitute the basis of every percept. As the assumptions were derived by actively dealing with the environment in the past, they provide through the percept which they bring about, a basis for more action: thus perceptions serve as prognostic devices for actions. If non-veridical perception results in wrong prediction for action and the experience of obstacles in the environment, new assumptions are formed and adjustive actions occur. Different individuals make different assumptions on the basis of different past experience.

8.84 Behind all action there is a purpose. Perception attributes to the environment the characteristics which in the past have furthered best our purpose. Thus a world of functional certainty is established and maintained as long as we can act purposefully in it. Purposeful behavior is directed to obtain subjective values from the physical and social environment by means of perception and action. The attention of the student of perception is focused on this transaction going on between organism and environment.

(For additional information, see: F. P. Kilpatrick, ed., *Human Behavior from the Transactional Point of View.* Institute for Associated Research, Princeton, 1952; and W. H. Ittelson and H. Cantril, "Perception: A Transactional Approach." *Psychological Monographs,* Doubleday and Co., Garden City, New York, 1954.)

8.9 Motivation Theory

8.91 The process of perception is determined by structural and behavioral factors. As structural determinants one defines the stimulus, the effects of stimulation on the receptors, the nerve cells, the sensory areas of the cortex, etc. Most of them represent "wired-in" equipment of the individual for perception. Theories of perception based on these factors have been defined as "formal." The behavioral determinants, on the other hand, are said to be expressions of "higher-level" processes. They include *"motivational" agents* such as: needs, drives, values (theoretical, economic, aesthetic, social, political, religious, etc.) tensions, interests, expectancies, defenses, emotions, attitudes, past experience, etc. Such factors may arise only temporarily or form a stable condition, which is called "personality." Whatever these words denote, they are said to constitute a central "directive state."

8.92 Theories of perception taking directive state into account are called "functional." "Formal" theories are criticized because they neglect these behavioral determinants. Structural factors operate only as built-in limits of the nervous system. They determine how far behavioral factors can influence perception. Whereas structural factors tend to produce veridical perception, motivational agents would have "distorting" effects. In order to obtain these effects in an experiment, "marginal conditions" are introduced in order to create some disadvantage for the functioning of structural factors.

8.93 Experimentation has shown some evidence for the following hypotheses:

1. Needs, like hunger or thirst, influence perception.
2. If the perception of an object is coupled with reward or punishment, these factors determine what is perceived, the magnitude of the perceived object and the speed of recognition.
3. The value which an individual attaches to an object influences perceived magnitude (e.g., the same coin appears of different size to a rich and a poor subject).
4. The personality of the individual influences his perception. Drive, autism, phantasy, etc., are said to be personality characteristics which determine the perception of objects in key with those characteristics.
5. Words which have a threatening or disturbing connotation for an individual require a longer recognition time than neutral words. They are also often misperceived and may provoke emotional reactions before they are recognized.

(For additional information, see: J. S. Bruner, and L. Postman, "Perception, Cognition, and Behavior," in *Perception and Personality: A Symposium*. Bruner, J. S., and D. Krech, eds., Duke University Press, Durham, 1955. G. Murphy and F. Hochberg, "Perceptual Development: Some Tentative Hypotheses." *Psychol. Review*, 58, 332-349, 1951.)

8.10 Hypothesis Theory

8.10.1 The fundamental idea of hypothesis theory is that perception and other cognitive processes work on the basis of hypotheses which are confirmed or disproved by experience. The organism adjusts to the environment by finding tentative hypotheses confirmed or by rejection of "false" hypotheses. If some percept, image, or memory is attained which fits the expectations of the hypothesis, the latter is said to be confirmed. If the data from the environment do not fit the expectations of the hypothesis, the perception of the circumstances remains a hazy one. In this case the organism tries another hypothesis.

8.10.2 There is always a prior hypothesis underlying perception, to which new information is added. If the prior hypothesis has received much support by cognitive or motivational factors, a greater number of trials and errors will be required to induce the organism to give it up.

8.10.3 The concept of hypothesis is equivalent to the concept of set. Sets as hypotheses, are established by previous perception and may be almost at the threshold level when the new stimulus is present. Sets also select and organize the sensory information from the environment. Cues from the environment are used to confirm or reject hypotheses or to establish new hypotheses. Sets, as hypotheses, are said to depend on both central motivational and cognitive processes and the environment.

8.10.4 Confirmation or rejection of hypothesis takes place according to the following *Laws of covariation:*

1. Strong hypotheses are more likely to arise than weak hypotheses because they require less supporting stimulus information to be confirmed. The inverse holds true for weak hypotheses.
2. Strong hypotheses require a large amount of contradictory stimulus information to be invalidated. The inverse holds true for

weak hypotheses. *Contradictory stimulus information is covariant with hypothesis strength.*

8.10.5 The strength of a hypothesis depends on how often it has been confirmed in the past. The more often this was the case, the less stimulus information is necessary to confirm it later. Also, an isolated hypothesis has more strength than one that concurs in the same perceptual situation with others. In the competition of several hypotheses the strongest one that fits the information is confirmed.

8.10.6 If a hypothesis has a strong motivational support it needs less positive stimulus information to be confirmed, and vice versa, more contradictory stimulus information to be infirmed. Thus reward and punishment may strengthen a hypothesis. Pleasant or unpleasant emotions may lead to readier confirmation. Hypotheses instrumentally related to personal values are stronger than hypotheses without instrumentality.

8.10.7 If a hypothesis has cognitive support (that means, is part of a larger system of hypotheses related by a common principle) it needs less pertinent stimulus information to be confirmed and it will be more unlikely to undergo changes over time.

(For additional information, see: L. Postman, Chap. 10 in: *Social Psychology at the Crossroads*, J. H. Rohrer and M. Sherif, eds., Harper and Bros., New York, 1951. Allport, *op. cit.*, pp. 375-436.)

8.11 Topological Theory

8.11.1 According to the topological theory of perception, each individual is surrounded by a "phenomenological field." This field consists of the individual's experience about the world in general, the objects and his own self. The forces of this psychological field exert their pressure on the individual. He experiences himself as moving ("locomoting") under their influence towards positive goals or away from negative goals. The region of the psychological field in which the individual experiences himself as acting is called "life space."

8.11.2 The life space contains barriers which block the direct access to the goal. Certain maneuvers become necessary to go around the obstacles. By this maneuver the life space is divided into sub-regions ("situations"). The life space is thus made up by pathways which connect individual and goal. This connection need not necessarily be the shortest, especially if the direct way is blocked by obstacles. The "locomotion" alters the psychological field such that all its forces come into equilibrium in the point region of the individual according to the principles of least action and minimum of energy.

(For additional information, see: Kurt Lewin, *Principles of Topological Psychology*, McGraw-Hill Book Co., New York, 1936.)

8.12 Learning Theories

8.12.1 Some theories of perception hold that past experience, and hence "learning," play an important part in perception. On the other hand, learning theories have claimed that perception theory is a subordinate part of learning theory. The two major learning theories involved in this claim are Hull's "Systematic Behavior Theory" and Tolman's "Sign-Learning Theory."

8.12.2 **1. The "Systematic Behavior Theory of Learning."** This theory is based on the experience with gradually strengthened connections between stimulus patterns and pertinent reactions. Learning is said to be an increase in "habit strength," where habit strength means a particular S-R linkage. This strengthening is a consequence of "reinforcement." It occurs if some trial is repeated many times and if the repetition is accompanied by the reduction of need or drive. Learning is produced by providing this reduction every time a "correct" response is given, by "rewarding" it systematically. Thus learning is an acquisition of a strong S-R pattern through reinforced repetition.

8.12.3 **2. Sign-Learning-Theory.** According to this theory, the organism acquires knowledge in the form of perceived and remembered means-to-an-end relationships. Pathways or tools to reach certain goals are recalled. Certain objects in the environment are recognized as signs which stand for expected goal objects ("significates"). There are three types of relationships which are recognized:

1) Expected connections of primary goal objects to drive satisfaction.
2) An expected relationship of some object in the environment to the primary goal object.
3) Sequential relationships among events in the environment arousing "field expectancies" (future objects and relations among future objects).

8.12.4 Expectancy is here equivalent with a "hypothesis" which may be confirmed (or

"learned") through successful achievement of the goal. What is learned in one situation may be "transferred" to other situations, in which the circumstances need not necessarily be identical. Motivational determinants (not reinforcement) are the forces behind learning. "Drives" produce tensions and tensions lead to "demands." The organism aims at direct drive reduction (primary demands) or at instrumental for drive reduction (secondary demands).

8.12.5 **3. Learning Theories and Perception.** Tolman's theory of sign-learning is related to Gestalt theory and topological theory. The notion of behavioral and perceptual expectancy (hypothesis) is similar to the concept of perceptual set. Thus perception of "signs" in the "field" can be said to be a necessary aspect of learning; learning is dependent upon perception.

8.12.6 Hull's systematic behavior theory, on the other hand, is not concerned with perception per se, but with the mechanics of S-R connections. Given this framework, one can be interested in perception only in terms of analyzing certain perceptual habits established through reinforcement by means of rewarded perceptual performance. Perception may thus be conceived as an (internal) response to an (external) stimulus.

8.12.7 Some features of perception can well be interpreted in the terminology of Hull's learning theory. Thus, "Attention," one of the intrinsic characteristics of perception, may be said to constitute the "reaction potential" of the internal response (perception).

(For additional information, see: E. R. Hilgard, *Theories of Learning*, Appleton-Century-Crofts, New York, 1948; and R. L. Solomon and L. Postman, "Frequency of Usage as a Determinant of Recognition Thresholds for Words." *Jour. Exp. Psychol.* 43, 195-270, 1952.)

9. A Basis for Decisions in Planning Communications

prepared by A. A. Lumsdaine

9.1 Communication Goals and Problems

9.11 Here, let us review some of the things you may need to consider as a basis for decisions you face in planning and designing an effective communication. There are decisions about the *communication goals* — what you are trying to do; about the questions of *when, why,* and *what* you may want to do to accomplish your purpose; and something about *how* you may go about doing the job. We will assume that you know the *who*: the audience you are trying to reach.

9.12 **Four General Questions** must be answered about communication goals. We will consider four general kinds of decisions, and some of the things you may need to take account of in making them.

9.13 1. What is the *need to be met* by the communication you are going to make?

9.14 2. What are the *types of communication goals* you are going to try to reach? These might be to teach specific skills or information, for example, or they might be to persuade your audience to accept a new belief or adopt a new plan of action.

9.15 3. What are the *obstacles* to be overcome in reaching your goal? These arise both from the nature of your audience and your purpose, and from limitations of time, money and other factors.

9.16 4. What are the *specific outcomes* you need to attain in order to reach the general goal you have set out to achieve? Here we have to get more specific about just what is to be communicated to whom, in what situation and by what means.

9.17 How effective a communication you will finally achieve will probably depend to a large extent on how well you answer these questions. In part, this means both how clearly you define your answers to the *general* questions stated above. It also means how well you can state — and answer — the many *specific* questions that will arise when you raise these general questions in any specific situation — one in which you are going to try to make an effective communication.

9.18 The specific things you get into in answering these four general questions will overlap, and answers to one set of questions will depend partly on how you've answered the others. Nevertheless, it will be helpful to consider each of the general kinds of questions one at a time.

9.2 Background for Planning

9.21 First, a few general points. There is nothing in the four questions that says anything specifically about VISUAL methods of communication, as such. This is not accidental, because these questions are the ones that need to be asked first about *any* form of communication — visual, verbal, or other. They start, for the most part, from the standpoint of what you're trying to accomplish, not of *how* you're going to do it. Most often, the question of what kind of visual communication tools you're going to employ should not even be raised until you have determined what you're after. The ends have to be considered first, then the means — including the visual means, if any. Otherwise, you're putting the cart before the horse.

9.22 Planning a communication is something like taking a trip. You have to decide, first, whether the trip is necessary — what purpose it will serve (see question 1, above). Then you want to decide *where* you're going, before you're ready to consider the routes you might take, or what kind of vehicle you should use, to get there. The communicator who starts out by considering the visual or other vehicles of communication he might use before he decides what goals he wants to reach is like the person who worries

about what kind of a car he's going to drive before he has decided whether he needs to make a trip or where he is going. He may have fun driving, but he's not as likely to accomplish his purpose as if he'd asked the first questions first. When he does, he may find that he didn't want to take a car at all — maybe he should have walked, or taken a plane.

9.23 The specifics about what kind of communication vehicle you may want to use, after you've decided just what you want to use it for, will be dealt with later and in more detail. But here we are concerned with defining what we may want to do as communicators, and not — in any detail at least — with just how we are going to do it. So the things we will discuss will not be concerned primarily with visual means of communicating, or with specific means. Rather, we will be concerned with the *ends* which such means can be used to help achieve.

9.24 Once we have the ends we seek clearly in mind and know the obstacles which we have to cope with in meeting them, the battle is half won. Until we do this — or if we start out worrying about the means before we have defined the ends fully, explicitly, and in some detail — we are often licked before we have started. We may produce an interesting communication, but not a useful one. We may enjoy the ride — at least for a while — but unless we're luckier than we deserve, we won't get where we need to go.

9.25 One final word before we consider the four questions. Sometimes you may have days, weeks, even months to plan a communication. When this is so, detailed attention to the four questions will not only be worthwhile in terms of the payoff, but will usually be quite practical, especially if you start planning early.

9.26 But sometimes things aren't like that at all. The communication may be one you couldn't anticipate and plan for — an answer to a farmer's unanticipated question in a meeting or "across the fence," for example. Then you have to answer "off the cuff," and maybe you won't have time to even ask yourself the four questions, much less try to figure out the answers for yourself, before you have to start communicating!

9.27 Two or three things are worth noting about this kind of "impromptu" or off-the-cuff communication situation in relation to our four questions. In the first place, you can only do what you can do. The ideas for planning, suggested by the four questions, will be helpful and can keep you from making many mistakes when you have time to think them out in advance. When you don't, of course, you just have to plunge in and do the best you can. When that unexpected question is asked to which you have to reply on the spur of the moment, no one in his right mind would start out by spending much time asking, "Now just what is the need to be met? What goals . . ."? If he did, he'd never get to first base.

9.28 Just the same, though, the questions can be useful in two ways, even for this off-the-cuff situation. For one thing, you can keep the questions in mind as you start to talk, and may want to switch your tack if, for example, you decide that the problem is really not what it first seemed to be on the surface. A man may ask for *information* when what he really wants is *reassurance,* for instance; or your purpose in giving him information may really be to pursuade him to adopt some *action.* In this case, you need to cut the suit to fit the cloth: that is, select and interpret the information you give, not just to answer the question as asked, but to meet the need behind the question.

9.29 For a second thing, *practice* in looking at and analyzing a communication situation in some detail from the point of view of our four questions, in those cases when you *DO* have time for advance planning, will help you in reacting quickly and appropriately later when you're faced with the off-the-cuff requirement. You'll have analyzed similar situations before, in terms of the kind of need to be met, the type of person to whom you need to communicate, and so forth. So you'll have a better basis for being able to react promptly and not "goofing," because of that prior practice. When time is short, you take a short cut, in other words — but you're less likely to trip up on the short cut if you've surveyed that kind of terrain in advance.

9.2.10 So, recognizing the need for shortcuts in many situations, we are going to try to spell out detailed steps you can take with profit when time does permit—with two aims in mind. First, to help you make better considered decisions in situations that allow for advance planning; and second, to help provide a basis for quick decisions on what to say (or show), and how to do it, when you have to act on the spur of the moment.

9.2.11 Now, to turn to the first question — deciding *what is the need to be met.* It sounds quite simple enough — and sometimes it is. But often things are not quite what they seem at first glance. In fact, probably more communications fail by having a fuzzy or inaccurate notion of what *needs* they are supposed to help meet than fail because they are poorly carried out.

9.3 Defining the Problem: What is the Need to be Met?

9.31 **1. The origin of the problem.** Communication needs don't all arise from the same origin. The need may, in fact, stem from what your boss has told you to do, from some idea you have dreamed up by yourself, or from some new policy or program that your national, state, or local governing agencies have initiated. On the other hand, it may arise from a question you've been asked by a farmer or a homemaker or other citizen, or from any number of other sources.

9.32 It will be useful to identify two main kinds of origins, because some of the problems these two pose for the communicator are different. The first main kind of origin is the need for communication created by you or your boss, or some external agency. An example would be when you must report the discovery of a new insect control measure, when your boss wants to explain a new policy to the public, or when the government wishes to advise farmers on how they might qualify for a support program.

9.33 The second kind of origin is the need arising, so to speak, from the audience itself. They have a question or a need for information that they are aware of and want help on. For instance, a group of farmers may wish help on forming a cooperative to sell their produce; an individual farmer — or home owner — may want to know how to seed his lawn; a homemaker may want help on buying a new appliance.

9.34 **2. Differences that depend on the kind of source with which you are dealing.** An important difference between these two kinds of situations is simply this: In the second case, the audience already is interested, and already wants the information or help you can give them. Here your problem, though it may not necessarily be an easy one, is just to give them what they need. But in the first case, you have an additional job to do before you are likely to be able to meet their need: That is, you have to make them aware of the need, or arouse their interest in what you have to communicate. Of course, there are many ways of doing this, but unless you recognize the need to arouse interest in the first place, and do something to accomplish this effectively, your communication is likely to be unsuccessful, no matter how good it is in other ways.

9.35 Sometimes good visual materials may help, sometimes other devices are better — sometimes you may be able to build up interest as you go along, other times you have to build it up before you can start in on your main communication job. For instance, you may build interest as you go along if your audience is already physically present; you need to build it beforehand if you want to get them to come out to a meeting, or into your office, to talk with you or to hear (and/or see) what you want to communicate to them. When you tell someone face-to-face about a new insect control measure, you can give immediate attention to his reaction and you can adapt your message to meet his needs. However, if you must gather an audience first before you can deliver your message about the new control, you have the task of delivering another message which impresses the importance of the second major message upon possible receivers. If the need for the communication arises from an individual, you can almost immediately answer his question. If you initiate the message, you may have to build an interest to obtain an audience.

9.36 **3. The real communication need may not be apparent at first.** Another important factor will enter into our discussion later but also ought to be considered here in relation to determining the need to be met by a communication. There are several aspects of this important point.

9.37 When the need or interest arises from your client or audience, he (or they) may not have identified the nature of their need clearly to begin with. They may know they would like to get some information, but may not know quite what information they are seeking. They may be groping around, trying to find out how to ask the question that will express what they want. You may have to help them, and you certainly will want to be alert to make sure that their need is really what it seems to be. This sometimes takes skill and a certain amount of informal "talking around" before you can be sure. But if you don't make pretty sure of the real nature of the need, most of your communication from then on may be merely spinning your wheels.

9.38 **4. Sometimes you may need to play the main goal down.** Even when you have originated the need for the communication yourself, or otherwise feel clear about the objectives it needs to reach, you may find it better not to make a frontal attack. This is particularly true when your objective is to persuade or motivate an audience, be it a group or a single individual. Often, too direct an approach may arouse resistance and antagonism, where a less direct beginning may later put you in a position to make your point. As Alexander Pope judiciously observed,

when you seek to persuade, "Men must be taught as if you taught them not — and things unknown, proposed as things forgot."[1] You've run across supervisors occasionally, perhaps, who seldom will accept an idea of yours unless somehow you've given them the notion that they thought of the idea first. It's tricky to accomplish sometimes, because the initially perceived need may not be in fact the real one . . . sort of like the two families from the same town back home who met after touring Europe and the Middle East. As they discussed places they had been and other families from home in Europe, the man of the first family asked: "Did you see the Dardenelles?" "See them?" answered the second husband, "Why, we had dinner with them."

9.4 Determining the Goals You Want to Reach

9.41 In a way this may sound much like the first question — determining the needs to be met. In a way it is, but this question does differ from the first one in two important ways. First, we get more specific here: we want to determine just what to communicate in order to meet the needs we have identified. Second, the goals for any given communication are not only more specific than the needs that generate them; they may also be more limited.

9.42 The general need may be, for example, better knowledge of how to operate a farm effectively; but the specific goal of a particular communication may be just one step forward toward meeting this goal. A specific goal could be to teach a small grain farmer how to adjust his combine to avoid wasting a large percentage of his harvest. This would include a series of even more specific communications to show the farmer how to make adjustments on his machine, how to travel at a speed most efficient, and how to care for his grain by avoiding spoilage after harvesting. The general need might then be made more apparent, that by harvesting efficiently he makes more money; that by keeping his grain clean, he can avoid restrictions or penalties set forth by government policy on unclean grain. Perhaps the goal for a given communication might be only to get people to understand some of the reasons behind a policy. Rome was not built in a day; our immediate goal may be just laying a foundation on which later communications may build in order to meet the ultimate need.

9.43 **Two kinds of goals.** We may think of several kinds of goals to be reached by a communication — teaching skills, giving information, creating interest, changing attitudes, influencing people's behavior or beliefs, etc. At the outset, however, we can divide these into two general classes:

9.44 **Class I.** Specific teaching of skills and essential information that someone wants to learn, and which he has to put to active, specific use. In other words, training people to do a job that requires a reasonable degree of mastery of either knowledge or skill.

9.45 **Class II.** More general *"educating"* of persons in terms of influencing their attitudes, stimulating their interest; or *satisfying* their interests or curiosity, getting them to want to do something, persuading them to take a specific action or to adopt beliefs that will lead them to a given kind of action later on.

9.46 The various kinds of goals are grouped this way, into these two general classes, because of *differences in the kinds of communications* that are needed to achieve them. One difference is seen by considering two functions of giving information to people. If the purpose is to teach them specific information they can *remember and use* (Class I), detailed and complete presentation is needed, and probably repetition and rehearsal of it, to insure it will be mastered and retained in detail. But the same information might be given just to satisfy people's curiosity or build interest (Class II). In this case, it may not be imporiant that they master and remember the information in much detail; all we may need is that they be made aware of the general area, to be assured that we (the communicators) know what we're talking about.

9.47 The two classes differ, then, in *how much mastery* is needed. They may also differ in how much learning or change is feasible. With reasonable skill and patience we may teach skills, nomenclature, formulas, or useful facts, so they will be fully learned. Often, unless we can produce reasonable mastery, we have failed completely. A little knowledge may indeed be a dangerous thing when important actions depend on really *knowing;* a man who can half drive a tractor may be worse off than a man who can't do it at all.

9.48 But with goals of Class II, even a slight change in the desired direction may be helpful — and a slight change may be all it is reason-

[1] Note that this does not necessarily apply — in fact the opposite may apply when the communication is the "teaching" of factual information or skills that the audience wants to learn. Here it is usually best to be as explicit as possible about what you are going to teach.

able to expect to produce. Sometimes a training program, for example, cannot hope to teach all the knowledge involved in a given subject-matter area. However, if we are complete enough in our coverage and can open doors to greater interest or develop a curiosity and need for further knowledge, people often will seek additional information. Sometimes people will decide to search for knowledge by returning to formal classroom study.

9.49 So our approach, and the degree of completeness with which we should expect to proceed toward the goals, can differ greatly for the two classes.

9.4.10 The next section considers some further aspects of the "Class I" situation — where someone wants to learn something and we set out to teach it rather thoroughly. Then, in the section after that, we will similarly analyze the "Class II" situation — where all that is necessary, or possible, is to make some progress (as much as possible, to be sure) toward the kinds of changes in attitudes or knowledge that we want to influence.

Class I Goals

9.4.11 THE OBJECTIVES OF TEACHING: When we start to design any procedure or device that is to be used to teach people, we should deal first with two questions: What is the final human performance that we want to attain? What are the specific kinds of things that need to be learned to make this performance possible? For present purposes, we will distinguish five main kinds of teaching objectives.

9.4.12 First, we may be concerned primarily with the pervasive but seemingly simple forms of *specific verbal learning* that are easily describable in terms of "paired associates," or identifying such things as names and faces, tools and their names, commodities and prices, etc., etc.

9.4.12 Second, we may be interested in the learning of essentially *sequential* patterns, either verbal or non-verbal, as in memorizing a prose passage, a procedural list, or some series of acts for which we want a symbolic or verbal sequence to serve as a mediating device. The fact that chemical fertilizer labels indicate percentages of nitrogen, phosphorus, and potassium — in that order — even though designated by numerals, as 10-12-10, is an example of sequential patterns.

9.4.13 Third, we may, for example, have to deal with acquisition of usable concepts and principles that are ordinarily tied to some form of connected discourse, where "substance learning" or interchangeability of responses rather than fixed terms are essential.

9.4.14 On the other hand, we may be interested in teaching directly some kind of final performance. This may, fourth, be a *complex or generalized* skill — as a notable example, the use of concepts and principles in such intellectual tasks as "trouble shooting," diagnosing malfunctions in a piece of equipment, or other forms of problem solving.

9.4.15 Or, fifth, we may be concerned with a *specific, unitary skill* for a fairly restricted kind of act, such as the "sensory-motor" skills of typewriting, driving a car, or the use of hand tools.

9.4.16 In these five kinds of learning, outcomes are discussed briefly in relation to some of the characteristics of communications that seem most important for attaining each class of outcome.

9.4.17 **1. Teaching People to Identify Things** (or "paired associates"). The teaching of identifications, and devices used to assist in this teaching, can, of course, be done either individually or in groups. Where practical, individual teaching can be greatly superior because of the fact that different students learn at different rates and require different kinds of help; firm mastery of identifications (so that "what goes with what") is thoroughly enough learned to be remembered later when it is needed, unfortunately, most often requires repetition and rehearsal or practice — sometimes quite a lot of it. This is not easy to provide in a group communication situation — and your visual materials may often take the form of manuals, booklets or other materials that can be studied intensively by the learner if individual supervised drill is not practical. Despite its obvious inefficiency, the group lecture demonstration method is frequently employed for teaching identifications (or, at least, for presenting them and hoping they will be learned).

9.4.18 **2. Following Fixed Procedures** (information and response elements): Teaching of procedures may involve two distinguishable elements. The first is a "stimulus input" element or source of procedural instructions. The second is a response element or set of "manipulanda" with which the procedures can be practiced. Let us consider the latter first.

9.4.19 **Response elements.** For effective practice of procedures the student needs to have an opportunity to make appropriate responses

to the step-by-step sequence of instructions that outline the procedure, regardless of whether these are given by a manual, an instructor (e.g., yourself,) or some special kinds of devices. This may often be provided by the equipment he is learning to operate, the tools and materials with which he is to learn how to build, cook, or otherwise operate. Sometimes, however, if this would be too expensive or otherwise unfeasible, you may want to provide substitutes.

9.4.20 Parts of many procedures on expensive equipment can be carried out with only a replica or mock-up of the equipment. Even a simple photographic replica may sometimes be satisfactory when the responses are straightforward and already learned as individual units. In this case the steps of the procedure may be complied with, for much of the practice, simply by such surrogate responses as "pretending" to move a lever about the right amount, or doing a make-believe flip of a toggle switch from up to down, or by simulating the setting of a dial and indicating orally to what position it would be turned.

9.4.21 Cheaper devices may be better in teaching identifications and procedures in the same way. Learning to identify objects or components generally does not require the actual equipment; photographs or drawings often will obviously show substantially the same visual display, and are cheaper. Cost is brought out here, for both identification and procedural training has both direct and indirect effects. Not only may use of adequate surrogates reduce total cost of training; the fact that many copies of low-cost substitutes (picture or inexpensive "face" mockup) can be procured means that each student can have one, on which he can study or practice identifications and sequences for as much time as needed for him to master what he should learn.

9.4.22 With expensive equipment, or other difficult to arrange "real-life" substitutions, the time availability per student is limited; the student then does not get enough work to master the task. The importance of this consideration is hard to overestimate.

9.4.23 The portions of a procedure requiring real equipment or situations often comprise only a small proportion of the steps in a total procedure. Thus a simple "surface" mock-up may be satisfactory for practicing nearly all of the procedural steps, with real equipment being used only when required. This means that the number of items of expensive real equipment, or realistic situations, required for practice can be reduced by using a single piece for a number of students *at only the points where it is primarily required.*

9.4.24 **Information elements.** For many kinds of tasks at early stages of training, visual demonstrations accompanied by oral directions or explanation is virtually indispensable as a guide to initial following of procedures by the trainee. This aspect of the instruction is, of course, the first thing we think of in "communicating" skills or knowledge, but it has been given second place in this discussion because the directions communicated are so often ineffective unless provision is made for direct practice in carrying out these directions promptly and accurately.

9.4.25 **3. Learning of Concepts and Principles.** Since most principles are stated in verbal form, "knowledge" of a principle may be revealed either in terms of being able to state or re-state it in various forms and contexts, or being able to apply it to a variety of situations.

9.4.26 "The understanding" of the operation of a complex operation or situation may require concepts that relate a large number of observable indications to a large number of causes that operate in one situation. Since it may be difficult or impossible to represent all these complex interrelationships through study and experience of the actual situations, it often seems desirable to teach a student to represent and identify the component aspects and relationships in simplified (schematic or symbolic) form. Often, this is done in quite unsystematic fashion and the student must inefficiently "dig out" many of the pertinent relationships for himself each time he needs them.

9.4.27 Elucidation of concepts and principles as applied to a particular situation or a piece of equipment is perhaps most frequently accomplished by a combination of lecture (or "lecture-demonstration") and unsupervised individual study from manuals or instruction books. Visual aids in either situation may need to break down the total instruction into simpler aspects, one at a time, in order to avoid confusion. Subgoals of communication are then sought—one at a time.

9.4.28 **4. Decision-Making Skills.** Even when a person has mastered basic prerequisite knowledge and concepts concerning a problem or system, teaching is often required that will give him actual practice in making decisions involved in choosing alternative courses of action. For situations of any degree of complexity, skill in making such decisions for diagnosis or troubleshooting requires the ability to formulate efficient strategies of action. This may call for extensive opportunity for practice before satisfactory effectiveness is attained. For example,

"troubleshooting" even extremely simple equipment such as an automobile ignition system, or a farm lighting circuit, may pose quite a formidable problem to the novice.

9.4.29 When such skills are the communication goals, and individual practice in the real situation is not possible, simulated practice with suitable visual aids — films, charts, etc. — may often be helpful. Here again, though, the purpose to which such aids are to be put may greatly affect the kind of visual material that is needed. A chart or other visual aid designed to help teach procedures or nomenclature may be nearly useless for this kind of task. In any case, having clearly in mind the specific kind of outcome sought (in this case, developing diagnostic or problem-solving activities) will do much to structure both the visual and verbal components of the communication effectively.

9.4.30 **5. Training of Manual Skills.** Many of the simple and readily learned motor skills required in carrying out procedures in operation or adjustment of equipment require, despite their ease, considerable exactness and precision. Since much of the "feedback" in the performance of these skills is often based on "feel," learning them is often best done through practice with the real equipment so as to provide feedback in terms of resistance pressure, felt location and textures of surfaces, etc. Sometimes, however, isolated equipment components (e.g., just a spare carburetor, or piece of electric cable — not the whole engine or appliance) can be used for this purpose with considerable gain in efficiency.

9.4.31 For certain skilled acts, which are performed in locations that are difficult of access or impose similar difficulties, practice may be needed on the operational equipment as installed operationally, and so mounted that the learner must practice coping with difficult maneuvers or accomplish adjustments by feel on a component that is not visible. It is clear here that "visual" communication may not fill the bill. When this is so, of course, the thing to do is to use what will fill the bill. Once again, it's an accurate analysis of the ends — what needs to be communicated or learned — that should determine what means — visual or other — are used.

Class II Goals

9.4.32 COMMUNICATION FOR INFLUENCING SOMEONE. The communication of information where the purpose is merely to satisfy or build interest or curiosity has been noted above — as distinct from situations where real teaching is needed. It may be noted that an important question in identifying communication goals — that are to meet needs originated by the client — is to determine when the need is for the one and when for the other.

9.4.33 We turn now to other main kinds of communication goals when the communicator's job seems better described as an attempt to influence rather than to teach. We will distinguish several main types of goals that you may need to distinguish within this general class. As has been repeatedly stressed, identifying clearly which kind of thing you're trying to do (or need to do) is not only the first step but often the main step toward arriving at the basic decisions as to how to meet the goals.

9.4.34 **1. Getting Attention of Your Audience:** When individuals or a group comes to you and have themselves clearly identified the needs your communication has to meet, this is, of course, usually not much of a problem. But when *you* have originated the need for communication, getting the interest of your audience is always the first and sometimes the hardest step.

9.4.35 Visual materials designed to get someone to look, listen, attend should be designed *for this one purpose.* They need not necessarily be informative — they need only arouse interest, and be such as to carry that interest over into the specific actions of coming to hear and to see a demonstration, film, or talk; of getting a man to want to hear or see what you have to offer; and the like.

9.4.36 Notice this goal is *never an end in itself—it is only a means to an end.* It may call for ingenuity, imagination and work, but these — no matter how successful in getting the desired attention—are useless unless there is something to follow them up. The latter may be either something that achieves one of the specific kinds of teaching goals discussed above, or it may be a visual/verbal communication designed to produce some one of the kinds of changes discussed below.

9.4.37 **2. Changing People's Attitudes.** Attitudes are of great importance primarily because they can strengthen or weaken the likelihood that some desired action will be taken. The action desired may be voting, attempting, planting a given crop schedule, donating money, supporting a particular person's policies, or any of an almost infinite variety of other desired actions. In building favorable attitudes as a step toward desired action, an important question is: How soon? and How specific? is the action to be taken.

9.4.38 **a. Immediate predispositions.** Here the problem is quite closely akin to that of building up interest, except that instead of having only to overcome apathy and get attention, the communicator may have to try to eliminate some initial negative bias on the part of his audience. The means for doing this will always depend largely on the nature of the bias to be overcome. This bias may be, for example, the attitude that the speaker doesn't know his stuff, that he is impractical and not in touch with the audience's real problems, that he is conceited, that his topic does not bear on the problems the audience is really interested in.

9.4.39 There is no sure or uniform rule for how to overcome such initial undesirable attitudes. The most definite thing that can be said is that the way to overcome them will most often become clearer if one knows his audience — in the sense of knowing (not just guessing) what their initial biases really are. Sometimes this is all too apparent, but quite often it is not apparent at all. In the latter case, considerable preliminary exploration by informal interviews to sound out the audience's feelings and prejudices (either by the communicator himself or by someone who is helping him) may be of crucial importance.

9.4.40 The other general kind of immediate predisposition that is of importance can better be considered in terms of situations where some immediate action is desired (see below).

9.4.41 **b. Developing attitudes for later payoff.** Often it isn't the *immediate* effect that counts, but rather the building of a foundation of attitudes or convictions on which later action can be based. Sometimes this must be done gradually over a long period of time, and attempts to go too far all at once may be self-defeating. A case in point would be attempts to integrate schools at Little Rock. At first, the immediate effect was opposition, even violence. Two years later, the schools were integrated without serious disagreement. Again, leaving aside the difficult and crucial question of specific techniques of persuasion, we want to emphasize here the importance of clearly formulating the nature of the attitudes and predispositions that need to be built up. In a long-term campaign of gaining acceptance for a proposed change it is easy to get sidetracked and lose sight of the eventual goal. For this reason, a *written-out plan* of campaign is often important. This plan can spell out the eventual goal to be attained and can then list subgoals or cumulative partial changes.

9.4.42 As the campaign progresses, referring back to such a planning document at each new step of the way may help to keep the individual small steps from becoming ends in themselves and to insure that they contribute to the long range goal. Otherwise, we may find ourselves in the position many universities have had: they planned an appropriation campaign, relying to great extent upon individual conferences with legislators, news articles, profusely illustrated publications telling the story of the university and its needs. Then, when appropriations are made, all too frequently the funds not only are less than in previous years but carry with them criticisms for spending so much money on "public relations."

9.4.43 **3. Specific Behavior Changes (immediate commitment).** The importance of immediate commitment to a course of action is well recognized by revivalists and "sign on the dotted line" salesmen in business. The point to be made here is that if one builds up a favorable predisposition but then fails to provide opportunity and encouragement for *immediately* translating it into action, his audience may "cool off" or become distracted by other matters, and the potential effect of a highly persuasive communication can thereby be largely or entirely wasted.

9.4.44 **4. Sustained Behavior Changes.** Perhaps even more than specific changes in attitudes and behavior for the moment, people in educational work with adults are most concerned with achieving changes in attitudes and skills that will last for long periods of time. The philosophy of "helping people to help themselves" contains the implied objectives that as a result of a learning experience people will become more self-reliant, will be able to develop criteria for making their own decisions, and will develop initiative for seeking out information on their own.

9.4.45 Once the teacher has determined in his own mind what sustained behavior changes he desires on the part of the people, his next step is to analyze the prerequisites for this. In so doing, he will most likely find that the problem is greater than one of persuasion. While it may be necessary to get people interested, they will not continue to perform an act unless they have the skills to do so, have the information necessary, and find the doing rewarding in some tangible way.

9.4.46 Consequently, instructional plans for sustained behavior changes need to include a wide range of activities and problems, from those meant to provide motivation through the mechanics of followup. Frequently, it will be necessary to brief learners on the consequences of behavior

changes and how these can be interpreted and used. For instance, unless the farmer has been told that the anticipated yield increases from the use of new fertilizer also depend upon normal rainfall, his initial use of the fertilizer in a dry year quite likely will be his last. At the same time, the credibility of the person or organization who recommended he use it will tumble. Planned followup helps avoid such difficulties, or lessens their impact when the consequences of the change are not what was expected.

9.5 Obstacles to Reaching Goals

9.51 Communication strategy requires careful analysis of the obstacles to the goals. While the obstacles might be organized or categorized in a variety of ways, we review them briefly here in terms of personal, situational, and content aspects.

9.52 **1. Personal Obstacles.** These are found in both the source of the communication and the receiver, and include such major items as the knowledge each possesses, their attitudes, their communication skills, and the social-cultural context in which each is located. These items are discussed at length in the section on the "S-M-C-R" model. (Chapter 4.)

9.53 **2. Situation and Resource Obstacles.** Every person who plans communication or educational efforts will recognize the limitations of budget, time, and place. Rarely do we have all the money, or time, or physical facilities to do what we think would be most satisfactory. Consequently, we must do the best we can with what we have, bearing in mind the size of our audience, the competition for their time and attention from others, and the adequacy of the instructional materials available to us.

9.54 Assuming that the communicator with any experience at all can wrestle fairly well with most of the situation and resource obstacles, we will concentrate on some basic considerations relating to selection and use of instructional materials.

9.55 Too often, we fail to recognize the fragmentary nature of the stimulus provided by various training devices. We need to distinguish between visual aids and such media as sound films because of the incompleteness of the stimulus situation represented by most materials.

9.56 Visual materials for group instruction make no explicit provision for student response and feedback. Thus, they never provide a complete teaching situation, but are only adjuncts to teaching. For this reason, it is often difficult to control the effects they will have.

9.57 Moreover, even in terms of stimulus properties, most visual materials, excluding sound films, represent only an incomplete fragment of the total communication stimulus pattern. In thinking about their contribution, one must consider them in conjunction with other elements of communication, particularly the instructor's commentary, and the ways he uses them. Only the latter provide the factors of progression and pacing which make them anything other than a static, isolated, and often irrelevant fragment of the total situation.

9.58 Visual materials for lectures are sometimes classified into these three categories: Models or "mock-ups" using actual equipment or model components, interconnected to function more or less as they do in an operational installation; transparencies and similar devices such as slides, using optical projection of transparent photographic representations; wall charts, using photographs, drawings of system components, diagrams of their meter connections and functions, etc. Certain characteristics more or less specific to these devices are worth considering:

9.59 **Mock-ups or Models** (3-dimensional aids). One advantage claimed for such devices is that they can show such things as actual system function. Often this characteristic is not employed in actual classroom instruction, or not for more than a few seconds per hour. In some instances the noise produced by operating the equipment prevents the instructor from showing much of anything except that the system does, sure enough, "work"—a conclusion that the student might reasonably be asked to take on faith. In addition, the cost of such devices is great. Accordingly, it is difficult to recommend the large sums that such devices often require, particularly in view of the fact that the functions of visual display for which they are in fact primarily used can often be served as well or better by much less expensive forms of classroom training aids.

9.5.10 The exception to this rather strong indictment of such devices lies, of course, in those cases where students can usefully perform actual practice work with them. Such devices are frequently used as visual aids for lecture presentations in non-operating conditions, though with intact elements of operational equipment functionally interconnected. In other words, the teacher sets up the machine but never turns it on. The advantage of such a three-dimensional

replica can be seriously questioned, as compared to realistic depiction by means of photographic charts or transparencies. Its most appropriate use is in connection with procedural training.

9.5.11 **Transparencies** (projected aids). These are used with a standard, general-purpose transparency projector. This projects a series of transparencies providing much the same kind of display as the animated panel. Considerable flexibility and variation of depiction in such transparencies can be obtained by using multiple overlays or differential illumination of components or pathways. As compared with mock-ups or models, the transparencies are also far lighter and more convenient to use, as well as much cheaper and faster to produce. In view of the many advantages of transparencies, the cost and time required to design and construct mock-ups and models seems difficult to support on economic grounds — especially in instances where the kind of display produced by differential illumination actually serves a useful training function.

9.5.12 **Wall charts** (2-dimensional aids). One of the disadvantages of a "total" display is that so much material is present that a student may be distracted from focusing his attention most effectively on a particular aspect. A study by Aukes and Simon (1957), for example, showed that somewhat better learning was obtained in a lecture demonstration with an "add-a-part" display in which various subassemblies were added to the display as they became relevant to the accompanying exposition presented by the instructor. Such a display, also, shares with projected transparencies the further advantage that different forms of depiction can be used as appropriate.

9.5.13 For example, a series of charts can be used to trace physical as well as functional interconnections and teach locations. On the other hand, a close-up such as a cut-away drawing can be used when it is desired to focus attention on details of appearance or construction. Often this detail could not readily be observed by more than one or two persons at a time in a class viewing a mock-up or model of actual equipment.

9.5.14 It can be argued that the flexible use of lecture aids in the form of transparencies or wall charts has an advantage over other forms of displays, and should be given serious attention in competition with other more expensive and cumbersome teaching aids. Because of their much greater flexibility and ofter superior convenience and durability, transparencies are often preferable to wall charts, except where such factors as poor room ventilation give the wall charts an advantage.

9.5.15 3. **Content Obstacles.** Nature of the material to be communicated, the skill to be learned, or the concept to be grasped affects materially the job of the communicator. Much of what is involved here already has been implied in the previous discussions of personal and situational obstacles. To identify the content obstacles, the communicator needs to raise a good many questions, among which might be these:

—How new will this information be for my audience? Have they ever heard about this before? What do they already know about it?

—How complex is this process, this skill, this concept? Is it similar to something people are already doing? How does it differ?

—How much will people need to know to make the changes that I want? How little need they be told? Is there a danger in giving them more information than is really needed?

—What does what I propose mean to people in their own operations: A change in materials and equipment? A change in technique — an improved practice? An innovation, involving changes in materials, equipment, techniques, and resources? A change in enterprise?

—How well do I really understand this myself? Can I really discriminate intelligently until I know more about this?

9.6 Define Specific Outcomes

9.61 Steps in the communication planning process, if carried out as implied here, either begin with or conclude by the communicator's defining for himself the specific outcomes he seeks for his audience: — What does he want them to do? How does he expect them to be different? What kind of behavioral steps, in sequence, does he anticipate? What, in a sense, will be the initial and terminal outcomes?

9.62 Communication, when planned from this point of view, takes as its starting point where the people are now in terms of knowledge, attitudes, interest, abilities, and the like. The communicator selects his message content, his communication code, his treatment and transmitting channels accordingly. He stakes out in advance certain sub-goals or checkpoints so that he has some evidence he is succeeding or failing and some indication of why either may be happening. All of the communicator's actions are taken in a framework of analysis and evaluation; the visual aspects of the situation are only a part.

9.63 Any attempt to consider visual aids alone as elements in an instructional or other communication situation reminds one of the comments made by the late H. L. Mencken concerning painting, which he irreverently characterized as the "one-legged art" and contrasted individously with other arts (such as music) in terms of its lack of any pacing and progression. "The trouble with painting," said Mencken, "is that it lacks movement. . . . The best a painter can hope to accomplish is to fix . . . the momentary aspect of something. . . . The work that he produces is comparable to a single chord in music, without preparation or resolution."

9.64 Because of their static character and the fragmentary nature of the instructional stimulus they provide, it is obvious that the effectiveness of graphic aids or mock-ups in the classroom or lecture hall will depend largely on other factors — especially the instructor's presentation. For this reason, the amount of variance in total effectiveness that the devices may account for is hard to predict, or to assess. This can usually be done only for the *total* communication — including visuals — not just for the visuals alone.

9.65 Further, the graphic aid may, in fact, account for relatively little variance when used in the classroom. A widely-cited experiment by R. A. Swanson showed no difference in the effectiveness of several types of classroom training aids (including both 2-dimensional aids and mock-ups). Of primary interest here is the further fact that a later comparison with a control group, which received only the more or less standardized accompanying lecture *without any visual aids at all*, failed to show any measurable contribution for any of the visual aids used. That is, all gains in information measured, with the tests employed, were attributable to the oral component of the instruction. However, this experiment may show in part that it is difficult to devise tests that assess the contribution made by visual materials. It is clear both on grounds of common sense and of subsequent evidence that we cannot reasonably suppose that nothing at all was really contributed from the visual aids used in this experiment, as was made clear by a later experiment reported by Swanson, Lumsdaine and Aukes.

9.7 Simplification and Realism

9.71 One important factor in the design of displays is the kind of depiction employed to represent components and interconnections. For learning to identify individual components or objects, realistic depictions, through display of actual objects, or realistic drawings or photographs, are often indispensable. However, simplified representation, using symbols and lines, has been demonstrated by Swanson, Lumsdaine and Aukes (1956) to be superior in explaining functional interconnections of a system. Apparently, the simplified representation of components permits focus of attention on the interconnections by eliminating distracting cues present when the components are realistically portrayed.

9.8 Active Student Response

9.81 Some of the disadvantages of lecture-demonstration instruction can be partly offset, with demonstrable gains in effectiveness, if provision is made for *active student response* during the class instruction. The latter should be designed to serve much the same functions of quizzing, rehearsal, checking, and correction as in the case of teaching machines — through the advantages of individual student pacing is necessarily lacking (Lumsdaine, 1958).

9.82 Such student participation exercises are well worth consulting by those who wish to improve the effectiveness of visual aids in classroom instruction. The available evidence suggests that such methods can contribute appreciably to student motivation in a classroom situation, relieving boredom and inattention, but that their primary contribution is the direct effects of the practice that is provided on the learning of specific material.

9.9 Preliminary Tryout

9.91 Often a tryout of a preliminary form of a training device may pay large dividends in improving subsequent devices. Doing this will often result in clarification of many errors, misconceptions, or failures of comprehension which would otherwise go unnoticed but which, once detected by such a technique, can be readily rectified by modifying the device or the presentation.

9.92 Trying out a preliminary version of a device with sample groups of even a few students will often result in great improvement of the final product. Tryout of a preliminary "breadboard" mock-up is, of course, standard procedure for detecting deficiencies and improving design to obtain better equipment functioning. Unquestionably, it would be beneficial to extend this rationale to the development of almost all

training devices also — in order to improve the output of such devices as measured in terms of the amount of *learning* resulting from their use. Doing so will generally show that the payoff is in the sequence of ideas, associations, response opportunities, and similar factors — and not, primarily, in the slickness of the device in terms of fancy displays, realism as such, artistic rendering, or chrome trimming. Slickness may possibly have some effect on acceptability to students and their consequent motivation (though this has never been clearly demonstrated). More likely, its major effect may simply be in impressing training supervisors and administrators, and may have relatively little to do with the effectiveness of a device for training.

9.93 In any case, the importance of special gimmicks and display features designed presumably to enhance motivation can easily be exaggerated. Indeed, sometimes when an attempt to provide these takes the form of "fancying up" the device, distractions may result which can interfere with the student's attention to the essential learning task, and thus can have an adverse effect on learning rather than a beneficial one.

10. Research in Audio-Visual Communication

prepared by John Oliver Cook

10.1 Communication

10.11 One thing that all communications have in common is learning. Learning is the modification of behavior as the result of some prior experience. It excludes only those modifications that are due to such things as aging, fatigue, and physiological adaptation. Learning is involved whether we are expounding the benefits of contour plowing, explaining the second law of thermodynamics or yelling at someone to get them out of the path of an oncoming car. Regardless of what might be the remote aim of these or any other communications, if the communications do not modify subsequent behavior, then the communications will fail to achieve all of their purposes both immediate and remote.

10.12 Since the modification of behavior is so central to the process of communication, we can approach communication as a problem in learning. Just as the purposes for which we wish learning to occur may be many and various, so the particular thing we wish to be learned may vary. To pick examples from the extremes of the learning continuum, we may want someone to learn to recite the multiplication table, or to have what we feel is a sensible attitude toward science or his fellow man. Learning is involved in both of these cases, and in all the cases in between.

10.13 Learning is not confined to the acquisition of facts. It also includes the formation of attitudes, beliefs and other implicit responses that mediate overt behavior. In some cases the communicator is interested in immediate action, and not in retention. When someone is in danger and we yell, "Look out!", we are interested in evoking an immediate avoidance response, but we are not interested in whether at some future date the person can reproduce the stimulus situation or his response to it. In other cases we may be interested in the retention of an attitude but not in the retention of any specific bit of information. We may, for example, want a farmer to have a favorable attitude toward publications of the Department of Agriculture, though we may not be interested in his retaining any particular piece of knowledge about these publications, except perhaps where to obtain them. In still other cases, as when we are explaining how to use a particular piece of equipment, we may want the audience to retain detailed information. Retention is not a problem that can be readily separated from learning; in general those things that promote better learning also improve retention. The core of the problem is still learning.

10.2 Essentials of Learning

10.21 Fundamental issues in the area of learning are still a matter of dispute among psychologists. Some called "Contiguity Theorists" assert that what we learn are connections between particular stimuli and separate movements. Motivation and reward are held to be irrelevant to the learning process. Another group of psychologists, called "Cognitive Theorists," maintain that what we learn are cognitions, that is, relationships among stimuli. We can learn these cognitions without the benefit of either motivation or reward; however, we will not act on the basis of our cognitions unless we are both motivated and rewarded.

10.22 A third point of view, and the one that will be adopted here, has at least as many adherents as either of the other two and perhaps more. It is called "reinforcement theory." According to this view, there are four essentials of learning, namely, drive, cue, response and reward. If any one or more of these is absent, learning will not occur. Neal E. Miller (1957) describes these four fundamental factors of teaching-learning as follows:

> "*Drive* (motivation) — the student must want something.
>
> *Cue* (stimulus) — he must notice something.

Response (participation) — he must do something.

Reward (reinforcement) — he must get something he wants."

Except for some special problems of visual perception, most of the available information on audio-visual learning can be organized around these four factors.

10.3 Drive

10.31 Of these four important factors, we know less about the role of drive in audio-visual communication than about any of the other three. Everyone concedes the importance of this variable, but no one seems to know much about how to manipulate it to the advantage of the learning process. On most of the issues in this area the experimental findings to date are decidedly ambiguous. They suggest rather strongly that the motivational variable is of some importance in audio-visual demonstrations, but they indicate with equal convincingness that we are still in the dark about how to use it.

10.32 **The Interest and "Liking" Factor.** One issue that seems to be fairly well settled is that whether one likes an audio-visual demonstration, or whether one is interested in it for its own sake, is not related to the amount one learns from it. One experimenter (Vandermeer, 1950) studied the effect of two versions of a film on personal hygiene upon subsequent personal hygiene behavior such as washing one's hands after going to the toilet, purchasing a toothbrush, etc. One was a straight lecture film and the other was what has been described as "a jazzed-up version with folk music in elaborate Hollywood style." Both versions apparently produced some change in personal hygiene behavior, and both versions were about equally effective. Increasing the interest in the film as such did not seem to put its message across more effectively.

10.33 Another experimenter (Twyford, 1951) found a negative correlation between how much students liked a film and how much they actually learned from it. The more they liked it the less they learned from it, and vice versa. Another experiment (May & Lumsdaine, 1958) used two versions of a film which presented a scientific explanation of the seasons of the year. One version of the film had a live dialogue, while the other version had narration. Fifth grade school students tended to prefer the live dialogue version more than the narration version, and those who were shown the live dialogue version even expressed somewhat greater interest in the subject matter of the film than those shown the narration version. However, the amount learned from the narration version was greater than the amount learned from the live dialogue version.

10.34 These experimental findings suggest several conclusions: (a) interest in a film is not the same as interest in the subject matter of that film, (b) the amount of interest in a film does not predict the amount that will be learned from it, and (c) as a rule, technical slickness does not increase the amount learned from a film.

10.35 **Extrinsic Motivation.** Experiments using such extrinsic motivators as praise, reproof, and announcing that a test will be given at the conclusion of the audio-visual demonstration have yielded somewhat contradictory results. An experiment (Kimble, 1953) testing the effect of praise and reproof of students' performances on a test covering the preliminary phases of an instructional topic found that praise and reproof had no significant effect on subsequent test performance on material learned before the administration of praise and reproof. On material learned after the administration of praise and reproof there were, however, significant effects. The reproved group scored highest, the praised group next and the no-incentive-comment group lowest.

10.36 Another experiment (Levine) manipulated the strength of motivation of different groups of Air Force basic trainees by giving them different instructions. The high motivation group was told that learning the material in the film would be of great importance to them. For the low motivation group this instruction was omitted. Of the 35 test questions that were asked at the conclusion of the film, 10 of these questions were practiced by the audience during the showing of the review portions of the film and 15 questions were not practiced. The results of the experiment showed that under the low motivation condition significant gains were achieved on both the practiced and non-practiced items. Under high motivation, significant gains were found only on practiced items.

10.37 Some writers (Miller, 1957; Hovland, Lumsdaine, & Sheffield, 1949) hold that announcing that a test will be given improves the amount learned from an audio-visual demonstration. However, the experimental findings on this point are by no means clear-cut. Two experiments (Michael, 1951; Michael & Maccoby, 1954) have failed to find that a pre-demonstration announcement of a test makes any significant difference in amount learned from the demonstration.

10.38 Motivational Effects Upon Subsequent Behavior. While we know something about the effect of audio-visual demonstrations upon the amount learned from the demonstration we know relatively little about its motivational effects upon subsequent behavior. It has been found (May & Lumsdaine, 1958) that showing a film version of a novel does not induce pupils to withdraw the novel from the library. However, showing interesting filmed episodes from a novel did increase the number of pupils who withdrew the book from the library. But when they were tested over the content of the book (Stevenson's *Kidnapped*) only the boys — not the girls — achieved test scores reliably indicating that they had actually read some of the book. However, some of the girls may have read the book, but not found it as interesting and memorable as the boys did.

10.39 Another piece of evidence comes from the previously-cited experiment by Vandermeer (1950) who found that an audio-visual demonstration did have some subsequent effect on personal hygiene behavior. In summary, the scanty experimental results do suggest that audio-visual demonstrations may have some fairly long-lasting motivational effects, but we know too little about motivation in this area to enable us to use it with consistent effectiveness.

10.3.10 Building Motivation into Audio-Visual Demonstrations. Attempts to increase the effectiveness of audio-visual demonstrations, usually training films, by "personalizing" the message or by splicing in a motivational sequence have usually failed. A group of experimenters (Beck, Van Horn, & Gerbner, 1954) presented to two large groups of high school students two versions of a 10-minute teaching film entitled *Heredity*. Version A stressed the significance of the subject for the understanding of human affairs and made personal references to the viewer as "you." Version B was quite impersonal. The amount learned from the two versions was not significantly different.

10.3.11 Another experiment (Peterman & Bouscaren, 1954) on 3,968 basic airmen failed to show that a "motivational" introductory sequence significantly increased the amount learned from a film on *Reading Meter Scales*. In another study (Kendler, Kendler, Desiderato, & Cook, 1953) an attempt was made to increase the amount learned from an audio-visual demonstration of safety measures that one could take to reduce the likelihood of injury in automobile accidents. As a motivator, a full color film strip with sound accompaniment picturing the gory results of automobile accidents was shown in connection with a sound film strip demonstration of safety measures. The motivating film strip presumably produced some anxiety in the audience, thus increasing the drive. This might be expected to increase the amount learned from the demonstration of safety measures. However, it failed to do so. It produced no discernable effect on either learning or performance on the examination that followed the safety demonstration.

10.3.12 Another experiment (Feshback & Janis, 1951) concerned itself with the anxiety people have about dental health. Here, in connection with a film on proper care of the teeth, three groups of experimental subjects were shown a film which featured close-up shots of decaying teeth and diseased gums. Three versions of the horror film were produced: one designed to evoke a high degree of anxiety, one a medium degree of anxiety and one a very mild degree.

10.3.13 Ordinarily, one would expect that the higher the drive, the greater the amount of learning, but the greatest amount of learning that was achieved here was achieved by the medium anxiety group. Apparently the low anxiety group did not have enough drive. The medium anxiety group had more drive, and they learned something that reduced their anxiety, namely, how to take care of their teeth and thus prevent the awful consequences that they had just seen pictured. The high anxiety group had a great amount of drive, and they also learned, but they learned something that would reduce their anxiety even faster: they learned not to pay attention and not to think about their teeth at all. While this did not do their teeth any good, it did reduce their anxiety.

10.3.14 This finding illustrates an important point. A strong drive is an uncomfortable thing, and anything that reduces that drive is rewarding. People tend to do whatever will reduce that drive most quickly. The behavior that will reduce the drive most promptly is not always the behavior the communicator wants the audience to learn. To generalize we can say that the threat of punishment for ignoring a warning is an unreliable motivator, since it may produce sufficient fear to cause forgetting, not only of the threat of punishment, but of the warning itself.

10.4 Cue

10.41 Introductory Sequences. Attempts to improve learning by manipulating stimulus conditions have generally met with more success than those that try to achieve the same

end by influencing the motivational variable. Inasmuch as it seems so reasonable to expect that introducing an audience to the subject matter of audio-visual demonstration should increase the amount that they learn from the demonstration, it is rather surprising to find that experiments on introductory sequences in audio-visual demonstrations have met with mixed success and failure. Studies of methods of film utilization reported by Hovland, Lumsdaine and Sheffield (1949), by Wittich and Fowlkes (1946) and by the Australian Office of Education (1950) indicate that an introduction increases the amount learned from films.

10.42 However a study by Lathrop (1949) got conflicting results, using three films with and without an introduction. For two of the films the version with an introduction proved to be slightly superior; however, for the third film, the version without an introduction yielded higher learning scores. In a similar study by Norford (1949) using three other films, small differences were found in favor of the versions which included the summaries. Only one of these differences was statistically significant. The previously mentioned massive experiment by Peterman and Bouscaren (1954) using a "motivational" sequence, a "familar example" sequence and an "essential steps" sequence to a film on *Reading Meter Scales* showed that any one or any combination of these three introductory sequences failed to increase significantly the amount learned from the film.

10.43 An experiment by Weiss and Fine (1955) points a way toward the effective use of introductions to audio-visual demonstrations. They showed a sound film strip on the structure and functions of the UN to two groups of high school students. One group was given prior familiarization training on the key terms in the film strip, and this group learned reliably more from it than the group that was not given prior familiarization training.

10.44 An experiment by Wulff, Sheffield and Kraeling (1954) used a film on the selection and assembly of parts into an automobile distributor. They found that prior familiarization training, either on film or employing the actual parts, reduced the number of errors in the selection of parts. In assembling the parts once they were selected, the film familiarization group made fewer errors than the actual parts familiarization group, even though the latter group had handled the parts during the familiarization training.

10.45 In another experiment, Wulff (1954) again used the assembly of an automobile distributor. Prior familiarization with the parts and prior familiarization with the parts and their names were both found to be reliably superior to no familiarization with respect to (a) the number of errors in selecting the parts, (b) the number of errors in assembling the distributor, (c) the length of time required for selection, and (d) the time required for the actual assembly. Interestingly enough, with regard to the selection time, prior familiarization with the parts proved to be significantly better than prior familiarization with the parts and their names. This latter finding corroborates the earlier results of Jaspen (1948), who found that requiring the audience to learn technical nomenclature of the parts did not improve performance on an assembly task.

10.46 These two findings with regard to nomenclature suggest that people have individual ways of symbolizing objects to themselves. They make implicit perceptual responses to the objects — they may even apply names to them that are at variance with the correct technical nomenclature, but which are quite effective in guiding their selection of parts. Perhaps requiring them to learn correct technical names interferes with these implicit symbolization responses.

10.47 In spite of the contradictory results that experiments have turned up, the findings suggest that at least one tentative conclusion about introductory sequences may reasonably be drawn, and that is that introductions are more likely to be helpful if they are specific to the learning task, that is, if they familiarize the audience with some aspect of the task to be learned; if they preview the material and thus provide the audience with an additional practice trial; or if they provide an opportunity to learn important cues that will later guide performance during the learning of the task. This cue-learning is likely to be effective if it does not interfere with some reliable, previously learned cues.

10.48 Relevant Cues (Cues That Direct). Since we are operating under the assumption that learning consists in the attachment of responses to stimuli, the importance of relevant cues can hardly be overestimated. In most everyday learning situations, and certainly in audio-visual demonstrations, stimuli are not lacking. On the contrary, there are a great many stimuli, but not all of them are relevant; that is, not all of them furnish reliable cues to guide the learning of the task. An audience confronted for the first time with the picture of a milling machine is overwhelmed by the variety of knobs, handles, wheels and buttons that it sees, but not all of these parts have to be attended to in learning to operate the

machine. An effective audio-visual demonstration of this machine is one that will call attention to the relevant parts and let the others fade into the background.

10.49 Evidence of this is found in an experiment by Kimble and Wulff (1953). Using a sound film on the use of the slide rule, they found that a version of the film that incorporated cues to guide the audience in making correct responses produced superior learning. This superiority held when men were later tested on new examples not previously practiced and was found to hold both for more intelligent and less intelligent segments of the population tested.

10.4.10 There is experimental evidence for the effectiveness of particular audio-visual devices for calling attention to important cues. Lumsdaine and Sulzer (1951), using a film on how to read a micrometer, found that animation devices such as pop-in labels, moving arrows, etc., produced a marked increase in the amount learned from the film. Cartoons which emphasized certain features of depicted objects have also been found to be effective means of calling attention to relevant cues.

10.4.11 Ryan and Hochberg (1954) found that in a test of ability to duplicate the position of objects (a piston, a switch and a human hand) in briefly exposed illustrations, cartoons yielded the best results, followed by photographs, shaded drawings and line drawings, in that order. This finding is consistent with the results of experiments in teaching aircraft identification during World War II (Gibson, 1947). It was found here that distorting distinctive features of planes helped people to learn to identify the planes even without the distortion.

10.4.12 In making filmed audio-visual demonstrations, we can take advantage of the fact that since the audience views the scenes through the eye of the camera, the audience goes wherever the camera goes. This gives us, in effect, a movable audience. We can have 200 people simultaneously peering over the shoulder of a man who is taking a watch apart. This mobility of the camera enables us to provide an audience with cues that it could not obtain if it were sitting in a classroom watching a demonstrator perform a task. Such mobility is especially useful in teaching manual tasks.

10.4.13 Gibson (1947) found that using a zero degree camera angle was effective in teaching gunnery to aviation cadets. This camera angle — essentially an over-the-shoulder shot — permits the audience to view the scene from the point of view of the person who is performing the task. In another study, Roshal (1949) found that in teaching knot tying a zero degree camera angle was superior to a 180 degree camera angle. It seems reasonable to interpret this finding as indicating that placing the camera in such a way as to provide the audience with much the same cues that they will use in performing the task themselves is better than placing the camera in the position of an audience watching a demonstrator perform the task.

10.4.14 Interestingly enough, a "no hands" version of the knot-tying film in which the rope appeared to tie itself into a knot proved to be superior to a film in which a pair of hands tied the knot. One interpretation of this finding is that the hands are irrelevant cues. The learner needs to know how the ends of the rope should twist and turn, but he does not need to be taught how to move his hands in order to achieve this result, because his previous experience will have taught him that. Picturing the hands simply obscures the essential cues.

10.4.15 As another method of focusing attention upon relevant cues in learning from films, slow motion has been very little investigated, especially with perceptual motor tasks. However, an experiment by McGuire (1953c) found that in a simple perceptual motor task slow motion had a slight tendency toward producing better learning. It may be that slowing down the action allowed more time for the audience to learn the important cues.

10.4.16 **Additional Stimuli.** The general trend of the experimental findings would lead one to believe that extraneous stimuli, unless they focus attention on relevant cues, are not likely to be effective. An experiment by Weiss (1954) is a case in point. In the hopes of making the different steps in a process more easily distinguishable by using a distinctive extraneous cue to accompany each step, Weiss used five continuous pure tones to accompany the five steps in the construction of a regular pentagon, but this treatment failed to produce significant differences in the ability to construct the figure. It made no difference whether the tones were present or absent during training and/or during the test.

10.4.17 Along the same line an experiment by Neu (1950) found that inserting attention-gaining devices (*not* attention-directing devices) did not improve performance. In a film on machine shop measuring instruments, such relevant attention-gaining devices as slow, emphatic reading of the commentary, supplying machine shop effects where appropriate, etc. did

not help, while the use of such irrelevant attention-gaining devices as extreme close-ups, spotlighting, stop motion, pointing finger, zooms and other unusual camera angles actually detracted from the effectiveness of the audio-visual demonstration.

10.4.18 Providing background material that is not really relevant to the learning of the task at hand has similarly been found to be ineffective. In a film demonstrating how to assemble the breechblock of a 40 mm anti-aircraft gun, Jaspen (1950) found that explaining how the breechblock works did not help students learn how to assemble it.

10.4.19 Even such devices as subtitles have been found to be ineffective in at least one experiment (Miller & Levine, 1952). Using a film on Ohm's Law, Miller and Levine found no difference in performance among groups trained with (a) no subtitles, (b) major subtitles only, and (c) complete subtitles. A replication of the experiment (Miller, Levine, & Sternberger, 1952a) using the same film again found no significant difference between complete subtitles and no subtitles. These experimental findings run counter to the generally accepted theoretical expectation that if subtitles help to organize the material, they should therefore make it easier to learn.

10.4.20 One would also expect on theoretical grounds that the use of color in filmed audio-visual demonstration should be effective in those cases in which color provides an essential cue in the learning task, but while this may, in fact, be true, the experimental results in the general use of color are quite confused. Long (1946), in comparing the effect of color films and black and white films upon the learning of pupils in grades five, six, eleven and twelve, found that on retention tests after 4½ months the color films proved to be reliably superior for grades eleven and twelve. On immediate recall tests color films were reliably superior in grades six and twelve. For the eleventh grade group the black and white film was unreliably superior on immediate testing, but color was superior on delayed testing. This conflicting result is typical of crude experiments in which a full color version of a film is compared with a black and white version, and no cognizance is taken of the role that color plays in the learning task or of the other variables in the situation that may interact with the color variable.

10.4.21 In a much earlier study, McLean (1930) found that on free-recall tests, high school seniors recalled colored geography prints in a ratio of 5 to 3 over black and white prints. Vandermeer (1948; 1949), in two experiments using a black and white and a color version of each of five films on a population of ninth and tenth grade science students, found that although the students had a slight tendency to prefer the color films over the black and white, their preference did not reliably predict the amount that they learned from the films. On immediate recall tests, there were no significant differences in the amount learned from each of the two versions, though the scores for the color films were slightly higher in 4 out of 5 cases. In tests given six weeks later, in 3 out of 5 films the color film group retained significantly more than the black and white film group.

10.4.22 An interesting finding in the second experiment was that for those points in which color was an essential cue — that is in the case of diagrams in which color was used to emphasize certain parts — the mean scores were higher for the color group than for the black and white group. May and Lumsdaine (1958) report a study in which the fifth grade school pupils learned about as much from a crude black and white film based on the story board as they did from the finished film in color. All these findings make it amply clear that it is impossible to say that color, in and of itself and regardless of anything else, facilitates learning from audio-visual demonstrations.

10.4.23 Narration has generally been found effective as an accompaniment of an otherwise purely visual demonstration, probably because the narration directs the eye movements of the audience. An early study by McClusky and McClusky (1924) found that with pupils in grades five through eight an oral commentary increased the effectiveness of sound motion pictures, slides and photographs. Einbecker (1933) found that oral accompaniment was superior to a regular silent film on high school physics. In the previously cited experiment by Jaspen (1950) he varied the verbalization level, that is the number of words per minute of film, and found a medium level (in the case of his particular film, about 100 words per minute) to be best. In the previously cited study by McGuire (1953c) he found, in teaching a simple perceptual motor skill, that film plus narration produced reliably better results than the film alone.

10.4.24 Another finding of the huge Jaspen experiment (1948) disclosed that pointing out potential errors facilitates learning from audio-visual demonstrations. However, this finding should perhaps be interpreted with caution. On

the basis of what is known about learning in general it seems reasonable to suppose that if we are quite certain that an audience will make a particular error, then it would be worthwhile to point this error out and clearly label it as such, in order to enable the audience to discriminate it from the correct response. But if the audience is not likely to make the error, then calling it to their attention may lead to their learning it.

10.5 Response

10.51 Role of Practice in Audio-Visual Learning. In 1946, Mark May (1946, p. 1-12) expressed the viewpoint that is adopted here with regard to the practice variable in audio-visual learning. He contended that unless the audience makes some response that is relevant to the learning task, no learning will occur. Practice that goes on during audio-visual demonstrations may be overt oral practice, overt written practice or some other kind of overt motor response. That is, the learner may actually be saying something aloud during the demonstration, or writing something or perhaps even practicing what the audio-visual demonstration is demonstrating.

10.52 However, under ordinary circumstances the response that the audience makes is much more likely to be an implicit response. The learner may be talking to himself or making some other kind of implicit response, as a person frequently does when he is listening to someone give him directions about how to get to a certain place. The listener may nod his head, repeat the directions to himself, or perhaps make imperceptible pointing movements with his hands or feet. According to May, something like this must go on in order for an audio-visual demonstration to produce learning.

10.53 The picture of audio-visual learning that emerges both from theoretical considerations and from the experimental results is not a picture of passive entertainment, but rather a picture of a very active, though usually concealed, process. Kleitman (1945) found evidence that when people watch ordinary movies, there is a good deal of physiological activity going on which manifests itself in an increase in muscle tension and a consequent rise in body temperature.

10.54 Evidence of the importance of implicit responses comes from a very different source. Liberman (1954) was interested in finding out how people can tell two similar speech sounds apart. He concluded on the basis of his experiments that we discriminate between similar sounds that we hear by implicitly duplicating those sounds and then seeing whether or not they feel different. If this finding can be applied generally, it means that we talk to ourselves a great deal more than we think we do. Though it is speculative to say so, we may, in fact, implicitly symbolize in some way visual perceptions as well as auditory ones. When we are watching something we may be making implicit responses that serve as symbolic representations of what we see. This speculation, if true, would explain the remarkable effectiveness, as we shall see later, of implicit practice.

10.55 Overt Practice During Audio-Visual Demonstrations. The effectiveness of having the audience call out the answers to questions during audio-visual demonstrations has been shown by a number of experiments (Kendler, Cook, & Kendler, 1953; Kendler, Kendler, & Cook, 1954; McGuire, 1954; Kanner & Sulzer, 1955; Hovland, Lumsdaine, & Sheffield, 1949). In one experiment, however, having the subjects call out the answers to open-ended statments failed to produce an increase in the amount learned (Miller & Klier, 1953a). Another experiment by Miller and Klier (1954), this time using written practice, found that interpolating tests between repeated showings of a training film did not increase the amount learned from the film. However, the great majority of experiments utilizing overt written practice have found it to be effective (Michael, 1951; Michael & Maccoby, 1954; Kimble, 1954; Yale Motion Picture Research Project, 1947; Gibson, 1947; Brenner, Walter, & Kurtz, 1949).

10.56 The experimental findings on the use of actual practice of the learning task during audio-visual demonstrations are fewer in number and not quite so clear-cut. Roshal (1949) required the members of the audience to tie knots in rope during the showing of a film on knot tying. But this actual practice did not significantly increase the amount of learning from the film. Roshal attributes the failure of active rehearsal to improve learning to the fact that the film did not allow enough time for the audience to practice effectively.

10.57 An experiment by Jaspen (1950) lends some plausibility to Roshal's explanation of his findings. Jaspen used several versions of a film on the assembly of the breechblock of a 40 mm antiaircraft gun. He found that if the action of the film proceeded at a slow enough rate to permit the members of the audience both to assemble the breechblock and to follow the action on the screen without too much loss of attention to either activity, then actual practice of the learning

task was effective. However, if the rate of development was too fast, actual practice was slightly, and insignificantly, worse than none at all.

10.58 **Implicit Practice.** Perhaps the earliest study on audience participation, or actual practice during an audio-visual demonstration, was a study by Hall (1936). The practice in Hall's experiment was implicit practice. He simply projected questions on the screen during the showing of a silent film to junior high school science students, and he found that this procedure facilitated learning. Experiments by Miller and Klier (1953a), Michael (1951), Kendler, Kendler and Cook (1954) and by Kanner and Sulzer (1955) all found that implicit practice while watching an audio-visual demonstration facilitates learning. The latter three studies show that it produces just about as good results as overt practice.

10.59 The previously mentioned study by McGuire (1954) yielded a rather interesting result. In this experiment the task was to learn the names of nine mechanical parts. Forty-eight experimental subjects were equally divided among the six groups of a two by three experimental design in which speed of instruction was varied two ways (fast and slow) and practice was varied three ways (overt, implicit and none). The subjects in the four practice groups were given six instructional trials in which each part together with its name was shown on the screen for four seconds during the slow condition, and for two seconds during the fast condition. Six practice trials, in which only the mechanical part was shown, were alternated with the instructional trials. The two no-practice groups received only the instructional trials.

10.5.10 For the practice groups, overt practice consisted in writing the names of the parts; implicit practice merely in thinking them. Speed of instruction was varied only during the instructional trial; *not* during the practice trials. McGuire found that at the slow rate of instruction, overt and implicit practice groups did about equally well, but at the fast rate, the implicit group did significantly better. The overt practice group was superior to the no-practice group at the slow rate, but inferior at the fast rate, while the implicit practice group was superior to the no-practice group at both slow and fast rates.

10.5.11 While instructions to practice implicitly do, as a rule, produce superior learning, attempts to induce implicit practice by more subtle means have not always succeeded. In an experiment done at Boston University (1954a) an attempt to induce implicit practice by promoting "identification" between viewer and instructor protagonist and to induce implicit anticipatory responses by inserting slight pauses before the demonstration of each step in the learning task failed to improve learning.

10.5.12 **Effect of Practice.** The effect of practice during audio-visual demonstrations does not seem to be a motivational effect. Active practice on some points of an audio-visual demonstration does not improve performance on other points. Four experiments (Miller & Klier, 1953a; Kanner & Sulzer, 1955; Michael, 1951; Michael & Maccoby, 1954) have all demonstrated that the effect of actual practice is specific to the items practiced, and does not carry over to non-practiced items. According to Hovland, Lumsdaine and Sheffield (1949) overt practice is especially effective for difficult items and for less intelligent learners.

10.5.13 **Role of Feedback in Practice.** Supplying the student with knowledge of results about his performance has been a cardinal principle of educational theory for a long time. This tenet receives some support from the findings of experiments on audio-visual learning. In the previously mentioned studies by Michael (1951) and Michael and Maccoby (1954) the experimenters used a film on defense against atomic radiation. They found that requiring the learners to write the answers to questions inserted into the film was effective, but only if they fed back the correct answers to the students right after they answered the questions.

10.5.14 In teaching aircraft identification, Gibson (1947) found that written practice with feedback and correction produced significantly better results than the practice alone. In interpreting these experiments, it is difficult to know whether to attribute the beneficial results to feedback as such, or to the fact that when we feed back the correct answer to the student, we are, in effect, giving him one more implicit practice trial.

10.5.15 **Response Guidance.** Another technique that has demonstrated its effectiveness in audio-visual instruction is response guidance. Rather than letting the learner make mistakes, especially in learning difficult material, it might be beneficial to guide his practice in such a way as to reduce the number of errors. One way in which this can be done is by instructing the students prior to the demonstration to pay attention to particular things in the demonstration. An experiment performed at Boston University (1954) which used a film on several kinds of map

projections found that instructing students to learn facts significantly increased their scores on factual items. Instructing them to learn general principles resulted in slightly and insignificantly higher scores on "principle" items. Less intelligent students learned more from the instructions to learn facts, and more intelligent students gained more from instructions to learn general principles.

10.5.16 Another response guidance technique is that of providing the student with cues during actual practice that will reduce the possibility of his making mistakes. In an experiment by Kimble and Wulff (1953) in which they used a sound film teaching the use of the slide rule, which permitted the students to write down the answers to particular slide rule settings during the showing of the film, they found that a version of the film which incorporated cues to guide the performance of the learner yielded superior results to a version that did not incorporate these guidance cues. This superiority held for both the more intelligent and the less intelligent segments of the population tested and was especially marked for the more difficult material.

10.5.17 Still another way to guide practice during audio-visual demonstrations is prompting. In a small preliminary experiment by Cook, Kendler and Kendler (1952) it was found that oral prompting during practice in naming conventional map signs gave slight, and statistically insignificant, indications that practice with prompting was superior to practice without it. The superiority of prompting seemed to be greatest when the material was difficult. Three subsequent experiments (Cook & Kendler, 1955; Cook, 1958; Cook & Spitzer, 1959) using the task of learning a visual code have demonstrated that showing the learner the correct answer before he makes his practice response produces better results than feeding the correct answer back to him after he makes his practice response. These experiments have shown, in other words, that response guidance by means of prompting produces better results than unguided practice with feedback.

10.5.18 **Amount of Practice.** Granted that practice on the part of the audience is essential to effective audio-visual communication, the practical question arises: How much practice is enough? Since, in most cases, the practice is implicit, the question becomes one concerning the number of reviews. The concensus of the findings is that audiences can usually profit from a greater number of repetitions than they are generally given. The person who creates an audio-visual demonstration is usually so familiar with the material that it may be difficult for him to believe that people cannot learn it in one trial.

10.5.19 An experiment by Sulzer and Lumsdaine (1952) employing a training film on how to read a micrometer gave different numbers of examples (up to ten) to different groups of experimental subjects. They found that the amount learned from the training film increased as a function of the number of examples used, though the rate of improvement decreased with each additional example. Rather surprisingly, they also found that the more intelligent learners benefited more from additional examples than the less intelligent ones did.

10.5.20 Brenner, Walter and Kurtz (1949) experimenting with two films, (a) *The Care and Use of Hand Tools — Wrenches,* and (b) *Snakes,* found that two showings of the films were better than one. A study by Kendler, Cook and Kendler (1953) varied the number of repetitions of the review section of a training film on conventional map signs. They found that one repetition of the review section was better than none, two repetitions were better than one, and three repetitions were better than two. In fact, the learning curve was still rising at the end of three repetitions, though the rate at which it was rising had somewhat diminished. They also found that requiring the audience to practice calling out the answers aloud during the showing of the review improved performance on the test by a fairly constant amount at every level of repetition.

10.5.21 The question of whether varied repetition is superior to identical repetition was investigated in a study by Kanner and McClure (1954). Using the same film on micrometer reading that was used in the Sulzer and Lumsdaine study, they compared seeing the same four examples twice with seeing eight examples all different in their effects on the ability of the learners to solve new problems. They performed the same experiment twice. The first experiment failed to find any statistically reliable difference between the varied and the identical treatments for mathematically naive subjects tested immediately after training, but it found a small, but reliable, difference in favor of the varied repetition treatment for somewhat more mathematically sophisticated subjects tested a week after training. In the second experiment, however, no statistically reliable differences of any kind were found.

10.5.22 A similarly negative finding was reported in an experiment by McGuire (1953a). In this experiment the length of the

film presentation designed to teach a motor skill (a pursuit rotor task) was varied. One group of college students saw a long film which contained four repetitions of each instructional point. The second group saw a shorter version which presented two repetitions of each point, and a third (control) group saw no film at all. Later tests of learning yielded a significantly higher score for the film groups than for the control group, but no significant difference was found between the scores of the four-repetition group and the two-repetition group.

10.5.23 An experiment by Kimble and Wulff (1954) addressed itself to the task of determining the relative effectiveness of different proportions of demonstration and practice in audio-visual learning. In this experiment, five groups of Air Force trainees were given the following five different ratios of instructional examples (answer given in the instruction) to practice exercises (answer requested of the trainee) in reading slide rule scales: 20 to 0, 16 to 4, 12 to 8, 8 to 12, and 4 to 16. The results suggested that the optimal percentage of practice exercises is in the neighborhood of 50 to 75 percent. A more detailed breakdown of the results in terms of the individual trainee's responses during the practice exercises indicated that this form of audience participation is not a single or unitary variable inevitably causing increases in learning of and by itself. Rather, it seems to be a condition under which such other variables, as elicitation of correct responses, exposure of the learner to relevant cues, and perhaps increases in interest and attentiveness may operate to increase learning.

10.5.24 **Distribution of Reviews.** Numerous learning experiments have well documented the contention that in learning anything that involves the establishment of new connections between stimuli and responses spaced practice is superior to massed practice. We get better results if we practice a while and then stop a while, practice a while and then stop a while, than we do if we practice continously for a long period.[1] This being the case, a number of experiments have addressed themselves to the task of finding out whether it is better to mass the reviews by postponing all reviewing until the completion of the audio-visual demonstration or whether it is better to space the reviews by reviewing each point right after it has been demonstrated.

10.5.25 Of seven experiments on this topic, five of them showed that it made no difference whether the reviews were massed or spaced. McGuire (1953) used a film on how to acquire skill in the use of a pursuit rotor. The experimental subjects in the spaced condition were shown the first half of the film (two repetitions) and then they performed in a five-minute test session. They were then shown the last half of the film and given a five-minute rest period before the second five-minute test session. The subjects in the massed condition were shown the full film (four repetitions of the set of instructional points) and then they performed in the two five-minute test sessions with a ten-minute rest between sessions. Both groups of subjects performed about equally well.

10.5.26 An experiment by Miller and Levine (1952) employed a film on Ohm's Law. The experiment compared a massed review procedure with a spaced review procedure and found massed review to be significantly superior. However, a replication of this experiment, by Miller, Levine and Sternberger (1952a) using the same film failed to find any difference between the massed and the spaced procedures. Acting on the assumption that the failure to achieve significant differences in this experiment was attributable to the intrinsically boring nature of the film, the same team of experimenters (Miller, Levine & Sternberger, 1952) replicated the experiment, this time using a color film called *Pattern for Survival*, a film on atomic attack. This time they found the massed review condition to be significantly superior to the spaced condition, and the spaced review to be significantly superior to no review at all.

10.5.27 However, another replication of the experiment by Miller and Klier (1953a) found no significant differences between massed and spaced review on either the immediate recall test given right after training or on the retention test given three weeks later. A further investigation by Miller and Klier (1953) disclosed no significant differences between massed and spaced review when these techniques were combined with implicit practice. Similar results were obtained in an experiment by Ash (1949). Using two film series each consisting of four 15-minute silent black and white films, Ash found that showing all four films in a single, one hour session was as effective, as far as retention one or two weeks later is concerned, as showing the films in two 30-minute sessions or in four 15-minute sessions.

[1] This contention is not true in the special case of problem solving or puzzle learning. Solving a problem or working a puzzle is largely a matter of extinguishing the wrong responses rather than acquiring the correct one, and since massed practice is known to produce faster extinction than spaced practice, massed practice leads to faster problem solving than spaced practice does.

10.5.28 Faison, Rose and Podell (1955a) inserted 30-second rest pauses every five minutes in a 20-minute film on basic electricity. They found that the rest pauses increases audience attentiveness as measured by a specialized infrared film technique which they describe elsewhere (Faison, Rose, & Podell, 1955). The use of rest pauses also produced a rather slight, but statistically significant, increase in the amount learned from the film. Both high and low intelligence groups benefited from the rest pauses, and the improvement was not confined to material covered in the period immediately following the rest pause. Though such a technique as this bears little relation to the issue of massed versus spaced practice, it is apparently an effective technique for waking the audience up periodically so that they can pay attention to the demonstration.

10.6 Reward

10.61 Nature of Reward in Learning. Probably most psychological theorists believe that reward (reinforcement) is essential to learning, or at least to performance. If true, this means that in order to do, or perhaps even to learn, what we are taught, we must be rewarded for it, and if our performance is not closely followed by some form of reinforcement we will be eventually cease to perform; that is, the response will become extinguished. But rewards are relative to drives. What would be a reward to one person, or one organism, with one drive might not be a reward at all to another organism with a different drive. Dry food is a reinforcement to a hungry rat, but it is no reward at all to a rat that is thirsty but not hungry. An important principle of reinforcement is that the longer the reward is delayed, the less effective it will be. For maximum effectiveness the reinforcement should occur immediately after the performance of the to-be-learned response. As N. E. Miller (1957) points out, "when the reward is delayed it is necessary to have some stimulus trace, symbolic response, or token-reward to bridge the gap by being immediately associated with both the correct response and the eventual reward."

10.62 Just as a distinction is made between such primary (physiological) drives as hunger, sex, thirst, and sleep, and such secondary (learned) drives as loyalty, cupidity, and fear, so a corresponding distinction is made between primary and secondary rewards.

10.63 Role of Reward in Audio-Visual Learning. In dealing with people in most teaching-learning situations, what we have to work with are secondary drives and secondary rewards. The extreme difficulty of manipulating these variables is reflected in the fact that there is practically no experimental data on the topic of the role of reward in audio-visual learning. There is some excellent theorizing by Miller (1957) and some sketches of possible experiments have been published by Kendler, Kendler, and Cook (1951) but there is very little in the way of experimental findings.

10.64 On an a priori basis, one could distinguish three possible types of rewards, (a) intrinsic, (b) extrinsic, and (c) vicarious. An intrinsic reward would be one that inheres in the response itself. If performing the to-be-learned act is itself reinforcing, if the activity itself reduces some drive, then the reward may be said to be intrinsic. An extrinsic reward is one that is not part of the act itself, but may, for example, be one of the consequences of the act. Such is the case when a student learns something in order to hear his teacher's praise. An experiment utilizing this form of reinforcement was performed by Kimble (1953). The power of this type of reward is indicated by Miller's statement that "films depend upon learned rewards reinforced in real life" (1957). If what one learns to do as a result of an audio-visual demonstration is not reinforced in real life, then the performance of the act will extinguish.

10.65 A vicarious reward is one administered not to the learner, but to someone with whom the learner identifies himself. For example, if a student identifies himself with the hero of the training film, and if the hero is rewarded in the film for learning what he (and the student) were supposed to learn, then this might operate as a vicarious reward for the learner. This area has been very little investigated, but an exploratory study by McGuire (1953b) suggests some interesting possibilities.

10.66 McGuire employed a film that contained "reward" sequences, that is, sequences involving a demonstration of the beneficial effects of particular instructional points. He analyzed the data to find out whether the nearness of an item to a "reward" sequence in the film had a significant effect on the learning of that item, and he found that it did. The effect approximated a double gradient forward and backward from the "reward" sequence. Apparently the closer an item was to the reward sequence, either before it or after it, the better it was learned. This experiment has never been replicated, nor

to the best of this writer's knowledge, has anyone else ever performed a comparable experiment in the area of audio-visual learning. Hence, for the present at least, the efficacy of vicarious reward in audio-visual demonstrations must remain in doubt.

10.67 Knowledge of results is sometimes spoken of as though it were a reward. It has been found to be effective, of course, but whether or not its effectiveness is a result of its reinforcing properties is still an open question. If a learner practices during an audio-visual demonstration, and if he is then shown the correct response, this showing may act as a reward if he has already performed the response correctly. However, it also operates as an additional implicit practice trial, and its effectiveness may be due to this rather than to any reinforcing properties.

10.7 Visual Factors

10.71 It is known from the experimental findings reported in the section on Cue that a fancy audio-visual treatment of a subject matter contributes little or nothing to its effectiveness. Mercer (1952) found that the use of such optical effects as fades, dissolves and wipes in a film did not aid factual learning. Somewhat more surprisingly, Cogswell (1952) found that in teaching a perceptual motor task, in this case the assembly of the breechblock of a 40mm anti-aircraft gun, a stereoscopic film yielded no better results than a conventional version. This finding bears out the conclusion of Gibson (1950), that the flat motion picture screen or the two dimensions of a picture or a still photograph can yield a surprisingly adequate visual perception of a three-dimensional world. Gibson's conclusion finds support in several experiments on the perception of distance in photographs and the representation of motion by still pictures. These are two areas in which still pictures might be thought to be quite inadequate, but they do surprisingly well.

10.72 **Perception of Distance in Photographs.** In a theoretical paper, Gibson (1953) suggested that there might be an optimal distance from the eye at which a photograph should be viewed. At this distance he suggested that the photograph would appear most like the real object. However, an experiment by Smith (1952) failed to find any evidence in favor of this viewpoint. Audiences were unable with any consistency to say at which distance the photograph looked most like the object it represented. Smith suggested that there might be a difference in the amount of linear distortion in photographs viewed at different viewing distances.

10.73 Evidence favoring this suggestion was disclosed in an experiment by Smith and Gruber (1954) and another by Smith (1958). These two experiments demonstrated that the farther away a photograph is from the eye, the greater the apparent distance between the observer and any point in the photograph, and also the greater the distance between two points within the photograph. An experiment by Smith, Smith and Hubbard (1953) was aimed at finding out what variables influenced the judgment of distances in drawings as compared to photographs. Their findings indicate that the judgment of distances in drawings is largely a function of linear perspective and is not much influenced by the amount of detail in the drawing or the degree of shading employed.

10.74 Further evidence of the adequacy of two-dimensional pictures in representing a three-dimensional world comes from an experiment by Smith and Smith (1954). They found that experimental subjects could toss balls at targets with rather surprising accuracy while not looking at the scene containing the targets, but merely at a picture of the scene. The situation was arranged so that the subjects were not aware that they were looking at a photograph.

10.75 **Representation of Motion.** Since pictures are essentially static, an interesting question arises as to whether they can portray events, which are things that happen. It is the contention of Smith (1952a) that they can. Smith points out that "A single photograph frequently contains sufficient information to warrant the inference that an object has changed in some way." Such changes as displacement in position are very easy to portray in a single still picture. This might be illustrated by a picture of a skier whose ski tracks on the fresh snow indicate that he has moved.

10.76 With regard to the portrayal of action, Smith acknowledges that still pictures cannot actually present motion, but he maintains that the picture may furnish enough cues to make it clear by inference that the object was moving when the picture was taken. It is also possible to indicate whether the action was a success or a failure, as in the case of whether a second baseman caught a baseball or not. If the picture shows the ball in the air, one can guess fairly accurately whether or not he will make the catch. Smith concluded that the perception of motion is not essential for communication about

events. An inference from this conclusion is that film strips, still pictures and drawings can frequently be substituted for motion pictures without any loss of effectiveness.

10.77 Some experimental confirmation of Smith's views is found in a study by Smith and Resnick (1953). They did several small experiments in which simple line drawings of human figures were shown to untrained subjects who were assigned the task of differentiating the static drawings from those depicting motion, and classifying the latter according to the amount of speed involved. They found that in general the subjects were able to distinguish the static drawings from the in-motion drawings, and they were also able to differentiate between different amounts of speed, though the accuracy with which they were able to do these tasks was relatively low. A reasonable conclusion from this study and the others mentioned in this section is that simple pictures give quite adequate impressions of distance and are surprisingly effective even in the depiction of motion.

10.8 A Psychological Analysis of Visual Communication Tasks

10.81 **Goals of Visual Communication.** In planning any sort of visual communication, a good starting point is to decide what you are trying to do. The goals of the communication process can be specified, and even classified in a number of ways. No one of these methods of categorization has any more intrinsic validity than any other. However, since psychological research deals with categories of behavioral events such as learning in general, or even particular kinds of learning, it seems reasonable to classify the goals of the communication process in a way that will enable us to make use of the research findings. We need a research classification scheme because in planning a particular piece of visual communication, we have to identify the kind of learning that is involved so that we can know which psychological principles are applicable to the particular problem with which we are dealing. While remaining consistent with the usual research categories (e.g., serial learning, perceptual learning, etc.), our classification scheme should at the same time be usable by those who are interested primarily in visual communication, and not in psychological research.

10.82 In accordance with these criteria, we can, in a common sense fashion, classify the goals of visual communication under the following four headings: (a) to motivate people, (b) to convey facts, (c) to explain something, and (d) to teach a perceptual motor skill. It now remains to analyze these goals, or tasks, in terms of the kinds of tasks that psychological researchers have studied. We have, in other words, to coordinate these communication tasks in some meaningful fashion with the categories that the psychologist uses in studying behavior, particularly learning behavior, since all of these four communication problems are included in the psychology of learning.

10.83 **Motivating People.** The role of the motivation variable, as far as we know it, in audio-visual learning, and the effect of audio-visual demonstrations, chiefly films, in motivating subsequent behavior have been discussed in the section on Drive. At this point, it might be worthwhile to make a distinction between, on the one hand, teaching somebody something that he is eager to learn, and, on the other hand, getting him to do something that he knows how to do but is not doing.

10.84 Motivational tasks can be further analyzed into two types: Motivating someone to do something, and motivating someone not to do something. In the case of the former type, if the person can be induced to perform the response once, then if he is adequately rewarded, this should strengthen the tendency to repeat the response. Hence, in this case, reward would seem to be a key variable.

10.85 But the case of teaching someone not to do something is a horse of a different color. This is one of the chief problems in teaching safety precautions, since so many of them are prohibitions. For example, it is difficult to train workmen not to leave tools lying around where they can get caught up by the machinery, damage it and perhaps injure several people. It is not feasible to use an extinction procedure in this case. Theoretically we could permit him to make the mistake, in the hope that the consequences would prevent his repeating it. But an awful lot of machinery would be wrecked in the process. A better way to handle the problem is to change it. Instead of teaching him not to do something, teach him to do something. Instead of teaching him not to leave his tools lying around, we could provide him with a fitted case, and teach him to get the tools back into the case at the completion of every job. Teaching him to do this is a much easier problem than the one it replaced.

10.86 **Conveying Facts.** Apart from any purpose we may have in communicating facts, the facts themselves may be either related to each other or unrelated, for example, a list of

names or book titles. Tasks of this kind are called serial learning tasks. Though the names can be presented in any order, they have to be presented in some order, and the extent to which the names are noted, learned, or remembered depends in part upon the order in which they are presented. Since organized material is easier to learn and retain than unorganized material, it would be desirable for us to impose some sort of structure upon the facts, to order them in some way, even though we are not interested in having the audience remember the facts in that particular order. Almost any sort of ordering will help, even if it is no more than arranging the names in alphabetical sequence. Organizing the material therefore is the first important principle to be observed in communicating facts.

10.87 A second important principle is that of the bowed serial position curve. When material is presented in the form of a list, it has been found repeatedly that items at the beginning and at the end of the list are learned more quickly and retained longer than items in the middle of the list. Retention is poorest for items just past the middle of the list, but as you proceed from this point toward the end of the list, or toward the beginning, the amount of retention for each successive item improves. The curve is pictured in Fig. 10.1.

10.88 We can combat the tendency of the curve to sag in the middle through the use of another principle called the von Restorff phenomenon. According to the von Restorff phenomenon, an item is easier to learn and to retain if it is isolated from the other items through being distinctive in some way or other. If we had a list of seven names, and we printed the fourth name in red, or in a different style of type, it would probably be retained about as well as the first and the last items. In fact, it would even improve the retention of the items on either side of it, and we would get two smaller bowed serial position curves, as in Fig. 10.2.

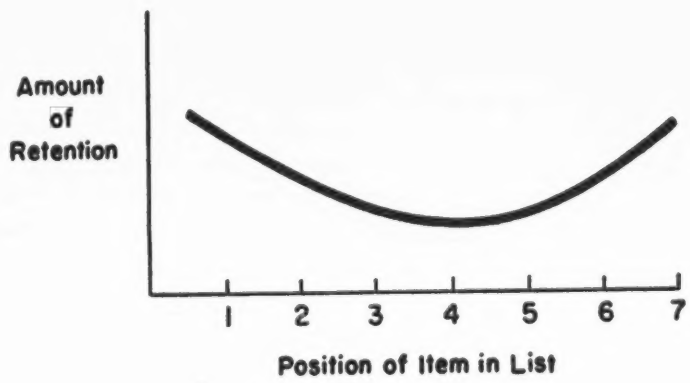


Fig. 10.1. Retention curve.

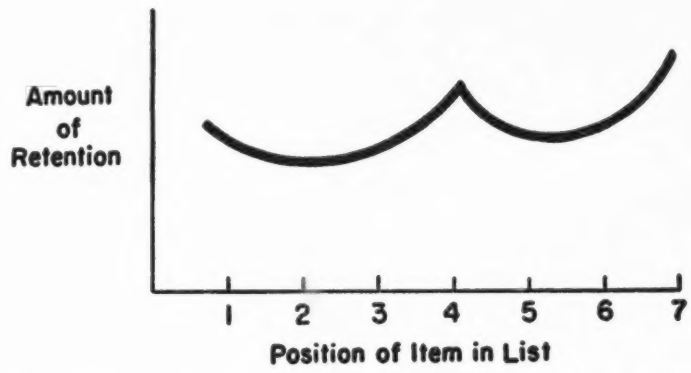


Fig. 10.2. The von Restorff phenomenon in a retention curve.

10.89 The principle of the von Restorff phenomenon is well illustrated in advertising displays. If a magazine has page after page of full page ads, each of which takes up an entire page, an ad that occupies only a small portion of an otherwise blank page will receive a disproportionate amount of attention. Similarly, a black and white ad in a series of full color ads will be outstanding. This would also be true of a full color ad in a series of black and white ones.

10.8.10 Turning now to related facts, perhaps the simplest way in which facts can be related is in pairs, as for example, when we say that Mr. Beach's phone number is 2-5138 and Mr. Digge's phone number is 4-9775. What we are trying to do in a case like this is to set up an associative connection between the two members of each pair, between Mr. Beach and his phone number and Mr. Digge and his phone number. Learning of this kind is called paired-associate learning, and it comprises a surprisingly large portion of everyday communication.

10.8.11 Paired-associate learning is involved when we tell someone that the drug store sells insect repellant, but the hardware store sells weed killer, or if we are telling someone what kind of fertilizers are appropriate to certain crops. In each case we want to establish an associative connection between the two members of the first pair and another connection between the two members of the second pair, and so on. In studies of conditioned responses it has been shown that a delay of even two or three seconds between the stimulus and the response increases the difficulty of getting the response attached to the stimulus. Hence, perhaps, the least efficient way of getting the desired connections formed is to increase the delay by separating the members of each pair, as we would be doing if we said "the drug store doesn't sell weed killer, it sells insect repellant." This would greatly increase the difficulty of the learning task.

10.8.12 Perhaps even more important than this finding is the principle of non-interference. What is true of the single items of information in the case of unrelated facts is also true of pairs of items. In the first place, it is advantageous to organize the pairs in some sequence. In the second place, no matter which sequence is used, the pairs at the beginning and at the end of the list will be retained better than those in the middle, and, in the third place, if one of the pairs is isolated from the other by being distinctive in some way or another, this pair will be easier to learn. But, in addition to these principles, there are some others that are peculiar to paired-associate learning.

10.8.13 The principle of contiguity is particularly important in communicating information of this kind. The principle of contiguity means that if two items are to be associated, they should be presented to the audience close together in space and time. Nothing should occur between the two members of the pair that would interfere with the formation of the connection between them. In everyday situations this principle is generally neglected. For example, the usual procedure in teaching vocabulary to very young children is to show them a picture and ask them what it is. If they fail to answer, or to answer correctly, then we tell them that this is a sailboat, or whatever the picture happens to be.

10.8.13a. In using this procedure, we are allowing a great deal of time to elapse between the presentation of the picture of the sailboat and the occurrence of the word "sailboat." Here, even a delay of a few seconds can make a big difference. Moreover, during the delay period, the child may make a wrong response, and the occurrence of this wrong response will interfere with the establishment of the connection between the word and the picture. The most efficient procedure is to present the picture and the word together again and again. Then if we want to know whether the child has learned the connection, we can test him, but it is important not to confuse the training and the testing.

10.8.14 Another important principle in presenting paired material is the use of previously formed connections as mnemonic devices in order to mediate the connection between the two members of the pair. For example, the names and phone numbers previously mentioned are difficult to remember, but we can make the task very easy by using the previously formed connection that we all have between the sequence of numbers and the letters of the alphabet. A is 1, B is 2, C is 3 and so on. If I point out that the phone numbers of Mr. Beach and Mr. Digge are the numerical equivalents of their names, no one would have any difficulty in remembering them. Needless to say, correspondences of this kind rarely occur by chance, but in many cases, one can frequently find some little device that will at least help to form the connection.

10.8.15 **Explaining Something.** A typical example of the communication of related facts occurs when we explain something to somebody. In a theoretical, scientific explanation what we do is to deduce the fact we are asked to explain from some more general statement. Thus the relationship here is a logical one. For example, we can explain why grass is green by deducing that fact from the general statement that all things that contain chlorophyll (and do not contain gentian violet or some other dye) are green, and that grass contains chlorophyll.

10.8.16 A more usual sort of explanation, however, is one in which the relationship between the facts is empirical. An instance of this is an explanation of a process or an explanation of how a piece of equipment works. Explanations of this kind are largely combinations of the two previously discussed kinds of learning, namely serial learning and paired-associate learning. Hence, all the previously discussed principles apply here.

10.8.17 To illustrate, suppose we were explaining to someone how a tractor engine works. In order to understand our explanation he would have to learn the meanings of a number of terms such as fuel tanks, fuel lines, connecting rods, cylinder head, etc. In other words, he would have to do a considerable amount of paired-associate learning. Moreover, he would have to learn a sequence of events, or in other words, he would have to do some serial learning as well. He would have to learn that the gasoline goes from the fuel tank through the fuel line to the carburetor and so on.

10.8.18 In most explanations of this kind, we can generally rely on a great amount of previous learning. He may have mastered all or most of the paired-associate component of the task, and so all we have left to teach him is the serial component. In situations like this we can effectively use symbolic diagrams rather than the actual equipment or even pictures of it. In fact, in some cases a symbolic diagram may even be superior, since it cuts down the number of extraneous stimuli — stimuli that are irrelevant to the particular task of learning how the machine operates. In one experiment performed by the

United States Air Force it was found that an elaborate display using actual jet engine parts mounted on a board and costing in the neighborhood of $80,000 was no more effective than a symbolic diagram that could be produced for less than five dollars.

10.8.19 **Teaching a Perceptual-Motor Skill.** As everybody knows, in training someone to perform a perceptual-motor skill the key concept is practice, but it is perhaps worthwhile to point out that not all perceptual motor skills are alike. A distinction, though perhaps not a very clear one, can be made between two types of perceptual-motor learning problem. One is the case of the person who has mastered all the components of a skill, but does not know which of the things that he has mastered are components, and furthermore does not know in which order to assemble these components.

10.8.20 For example, take the problem of learning to pick out a one-fingered melody on a toy piano with numbered keys. This is a perceptual-motor skill, but it can be learned by most adults in our culture without any overt practice whatever, since we do not need to learn how to strike the keys. What we do need to learn is which keys should be struck and in which order. To be sure, in learning this we need to practice, but we do not need overt practice with an actual toy piano, since the problem resolves itself into the serial learning task of memorizing a sequence of numbers. What we do need practice in is in implicitly saying the numbers to ourselves in their proper sequence. Perceptual-motor tasks of this type lend themselves very readily to teaching by audio-visual means to large groups of people.

10.8.21 Another type of perceptual-motor learning is one that might be described by saying that the person knows what should be done, but does not know how to do it. Learning a correct follow-through in driving a golf ball, or learning to play an arpeggio on a violin are cases in point. In these skills it would be an understatement to say that the cues are not readily symbolizable. Skills of this type may be considered to consist of a series of component responses. The cue for each component response is produced by the response that precedes it. The difficulty of learning a skill of this type is enhanced by the fact that if any component response is incorrectly performed it will furnish false cues for the succeeding response.

10.8.22 What is required to learn a skill of this type is actual overt practice with knowledge of results, plus whatever aid can be given by a coach or someone else who acts as a critic of the performance. What help a coach can give, though necessary, will usually be quite little, because the coach cannot provide the student with proper cues for the performance. Only the student can do that. Since the student must practice overtly, and since the cues for correct practice must be provided by the student himself, and cannot be either verbalized or presented to him in pictures, teaching a skill of this type is by far the most difficult task that audio-visual methods are called upon to perform.

11. Perception and Design

prepared by I. A. Taylor

11.1 Introduction

11.11 Application is understanding drawn out to its fullest implications. This section is concerned with drawing out many of the implications of the section on perceptual organization (Chapter 7) and showing their application to visual communication design.

11.12 Certain faulty notions about visual communication should be examined. In the first place, analogic or continuous symbols used in visual communication are not codified. Many of us for that reason do not realize that it is a communication system. This shows itself to be particularly true whenever individuals "ignore" each other's nonverbal behavior, reacting explicitly to words in the course of a logical discussion. Actually, nonverbal communication can be most reliable and efficient in many instances. It operates best, however, in conjunction with verbal communication in various audio-visual techniques.

11.13 In the second place, we frequently assume that visual communication lies exclusively within the realm of the artist and craftsman. This is an unfortunate assumption. To believe this would be to deprive ourselves of an extremely valuable form of interpersonal communication. With a little practice with various visual materials, skill comes rapidly. This is particularly true of simple graphics, e.g., figures, charts, plan drawings, and visual displays of ready-prepared material needing only suitable display. A display does not have to be a work of art; if it were, it might obscure the message. It should be simple, pleasing, and communicative.

11.14 Third, we do not always appreciate the potentialities of visuals for stimulating interest and learning. When we realize the degree of influence predominantly visual materials have on the public—TV, movies, magazines, etc.—in contrast to purely verbal material, it is surprising to find so much teaching or communication intended to influence behavior lacking in visual "aid." Actually, nonverbal forms of visuals are so much more effective than verbal communication that perhaps we should speak of "verbal aids."

11.15 Fourth, there is the basic fallacy that symbols themselves possess meaning. The meaning is not in the symbol but in us. The perceived symbol can only evoke a meaning depending on our previous experiences with it, similar symbols and the general situation in which it is presented. As Kepes stated it, "Visual experience is more than experience of pure sensory qualities. Visual sensations are interwoven with memory overlays. Each visual configuration contains a manifest text, evokes associations of things, events; creates emotional and conscious responses."

11.2 The Visualization Process

11.21 The visualization process should be understood as a mental process rather than a set of techniques; and forms are to visual communication what words are to verbal communication. The ability to visualize is highly creative, involving research, selecting, constructing and problem solving. Examination of the stages of the creative process itself is therefore in order. Wallas first formulated these stages in 1925.

11.22 **The Creative Process.** Several phases frequently overlap. The first phase, *preparation,* involves the initial and crucial process of becoming *exposed* to as much of the relevant material pertaining to the problem as possible. As a process of exposure, the "openness" of one's mind to a variety of approaches, ideas, principles, etc., is essential so as to obtain much "raw material" from which to create. Although the phase appears to be passive, since it is characterized by a great deal of reading, observation, and listening, it is quite active.

11.23 Few people are really trained to listen. More likely a person is thinking of his next action or statement while someone is presenting material. Too frequently the overanalytical mind operates to bar new knowledge from passing the threshold of perception with such questions as, "What good is this knowledge?" or, "How can I use this?"

11.24 Some of the most creative individuals relate to new ideas with a great deal of openness, receptivity, and acceptivity. The temptation to close prematurely is almost an irresistable drive for most persons striving for intellectual security. The fact is that unless an individual can allow himself to accept a great deal of information without pounding it into preconceived notions, he will be likely to employ strong stereotypes—a socially accepted disease, characterized by a "hardening of the categories"—and less likely to have a large assortment of information that can form into something significantly new.

11.25 The second phase has been called *incubation*. Assuming that the individual with a creative mind has filled his mind with unassimilated thoughts, these then begin to mill around and *interact*. This is frequently described as a tense, detached period—sometimes painful because it is essentially a condition of mental indigestion. There may be experienced a great deal of excitement as if something is getting ready to hatch.

11.26 The third stage is the *illumination* one—a moment (or period) of insight, understanding — the eureka! ah hah! experience. Suddenly all the various parts come together in a moment of *closure*. Frequently the illumination is reported to occur when least expected—while riding a bus, calling long-distance, dreaming, etc. To a large extent, unconscious forces seem to be operating. Of course, the moment of "inspiration" which frequently accompanies it is not the untainted moment of glory as most movies would have us believe. It is one of doubt, self-criticism, moodiness, and fear. This last, largely because it is a new idea and there is fear of social rejection or criticism.

11.27 We are, of course, describing great creative moments, but in varying degrees these characteristics are present even in the simple process of producing a routine interpersonal communication. Probably the most troublesome accompaniment of illumination is the knowledge that now the major task of putting the insight into tangible form for public inspection is necessary. This also ushers in new fears since in general the public operates somewhat like a mowing machine that does not allow new grass to grow too high.

11.28 The final task is that of *elaboration* or *execution* of a project embodying the new idea. In the course of execution, there is a great deal more interaction between idea and material consideration, the final product being a resultant, or rather compromise, between the two. The entire process is illustrated in Fig. 11.1.

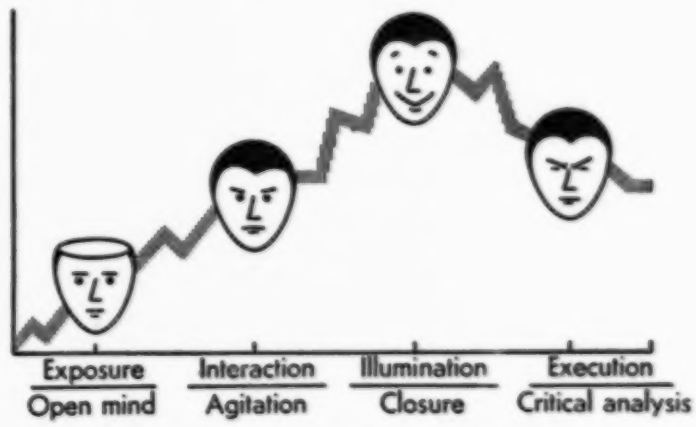


Fig. 11.1. Highlights of the creative process.

11.29 **General Development of the Plan.** What has the creative process to do with visualizing? At their best, the creative process and visualizing are psychologically practically synonymous. In visualizing—whether it be a display, bulletin board, or flannel board—the creative process proceeds by answering the question in approximately the following order.

11.2.10 **1. Determining the message.** To suggest that one needs to determine exactly what one is attempting to communicate before preparing a visual presentation can be misleading. Usually one finds that the best answer to the question, "What is the message?" comes during or after the presentation. Walt Disney is reputed to have once said that he never tries to figure out what he is trying to say in a production. This he leaves to the authorities to tell him later. At any rate, it would also be misleading to suggest that one should not attempt to crystallize the message beforehand. Probably the best guide is to remember that there are three "layers" to a communication: the *content* or statement itself, the underlying unstated *assumptions* upon which the content is dependent for communication, and the *purposes of the message*. In attempting to clarify the essence of a message the following checklist can be helpful.

11.2.11 Content

1. Is the message a description, interpretation, or explanation?
2. How many elements are involved and how are they all interrelated?
3. How novel is the idea? How provocative?

11.2.12 Assumptions

1. Are the underlying assumptions too complex to assume? Should they be part of the content?
2. Are they of a conventional or radical nature?

11.2.13 Purposes

1. Is the goal to reach with understanding or persuade without revealing actual purpose?
2. Is the aim to produce rewarding or threatening course of action by the observer?
3. How consistent is the purpose with the message?

11.2.14 2. Determination of the elements involved in the communication. After defining the message in terms of its content, purposes, and assumptions, it is possible to identify the number and nature of the elements. A decision has to be made as to which elements should be verbal and which nonverbal, depending essentially on the degree of abstractness or concreteness of the element.

11.2.15 3. Translation of ideas into visual symbols. The problem of producing communicating symbols that reliably evoke the intended meanings is essentially a problem known as *transposition*. Usually, it is a good idea to assume that anything can be visualized. The *meaning* of any idea is a matter of its inner relationships, largely communicated by the perceptual structural principles outlined in a previous section. One has to be aware of all major internal relations. For example, if I want to say, "drink milk," I am simply establishing a relationship between two elements where the direction of movement between one and the other can be easily visualized.

11.2.16 In concrete messages the visual symbols should be as pictorial or photographic as possible. In abstract communications the problem is far greater. Frequently the use of complex structural symbols are required: abstract shapes in moody paintings, complex formulas in mathematics, etc. There is much indication that of three major forms of visual symbol, the *icon*, such as photographic or realistic representation, is best for messages where *seeing* is essential, *schematic* representation, where exact relations requiring *thought* and problem solving are depicted, as in a blueprint; and *abstraction*, with irregular undefined shapes, particularly with colors, so as to produce *motivation*, movement, and attention. Thus, one should clarify whether the translation of idea should be essentially in perceptual (seeing), cognitive (thinking), or affective (feeling) terms. Fig. 11.2 illustrates the transposition of the idea of a person in these three ways.

11.2.17 4. Grouping and general relationships. A visualized plan is called a *layout*. Several rough layouts, omitting details, should of course be attempted and tested until simplification of idea and presentation is achieved. There are three major considerations in this process:

11.2.18 Consistency. The various elements should be compatible with regard to size, color and shape. Each element should lend itself to the simple theme and should be relevant. Otherwise, it can only obscure the message. The type of lettering should be considered from the point of view of the message and other elements. As much as possible, the verbal and non-verbal elements should be integrated rather than separately conceived and executed.

11.2.19 Emphasis. For clarity there should rarely be more than three magnitudes of elements and most frequently two. The major elements should be clearly distinguishable from the minor and sub-minor elements. Without thought to emphasis, visuals can be flat, "busy," and boring.

11.2.20 Arrangement. The most interesting design is an informal or asymmetrical balance with a certain degree of casualness. The skill is quickly achieved with a little practice. The effectiveness of many visuals is decreased by overlooking the importance of letter arrangement. The simple rule here is to keep lettering *simple*

Fig. 11.2. Transpositions of the human figure.

and *clear*. Simplicity is obtained by eliminating fancy ornamentation, and clarity, by using one of a wide variety of letter aids. These devices, requiring little skill for their use, include lettering pens, raised cut letters, precut letters, rubber stamps, stencils, lettering guides and mechanical lettering instruments.

11.3 General Perceptual Principles of Design Applied

11.31 There are structural and functional considerations in producing a design. The structural ones are related to the construction of the visual presentation and the relationship between its elements. The functional ones involve the attention-getting and mood-influencing properties produced.

11.32 **Structural Techniques.** The basic structural organization as previously discussed involves the putting together, gathering and grouping of elements, then the dispersion, separation and spreading of the element groups, and finally, the integration of the grouped and separated components into a coherent design. Under what conditions and for what purpose should the various organizational techniques be used?

11.33 **1. Techniques for grouping.** Whenever the content of the message is to produce an association between one or more elements or groups of elements (see Fig. 11.3), one of several of the following grouping techniques must be employed:

11.34 **Proximity.** Although elements placed together form a bond, the relationship is relatively weak, frequently considered accidental or arbitrary, or for momentary purposes. When a large group of diverse objects are shown in proximity, the grouping is generally interpreted as one of mere expediency. Whenever the content is to produce the feeling that there is a strong relationship between elements, proximity alone is inadequate. However, when the relationship between two elements is generally not recognized or accepted, a first step in the direction of communicating an association is simply to place them in proximity.

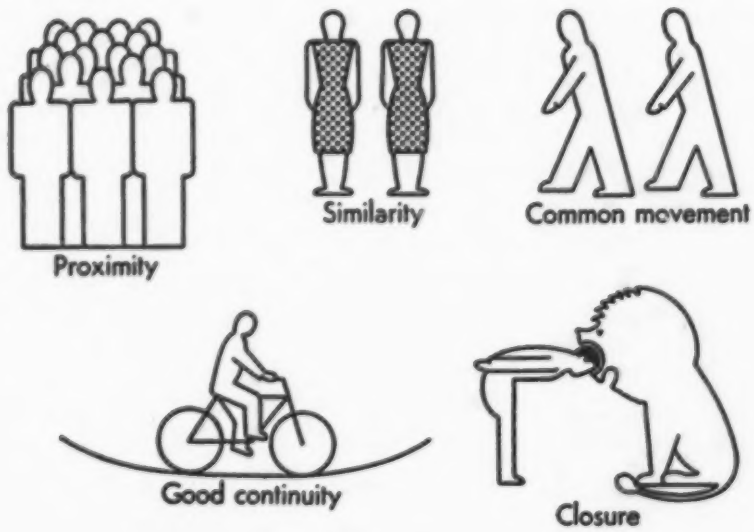


Fig. 11.3. Techniques of grouping.

11.35 **Similarity.** Distant objects with common features create a more subtle form of producing an association. Although the association may appear more basic it still has an arbitrary appearance. Conformity is the major social process producing a great deal of similarity in everyday life. If two elements in a visual cannot be brought together, or best be separated in terms of the message, the association can be achieved by giving them common properties.

11.36 **Common movement.** A more dynamic approach in introducing a bond is to have two or more elements move together. Movement generally causes more involvement and interest. The grouping in a visual composed of elements moving interdependently, as do the cars of a ferris wheel or changing lights, will almost invariably attract attention. And if the elements are different, the observer usually attempts to figure out how they relate.

11.37 **Good continuity.** One of the best ways to organize highly disparate elements is to distribute them along the contour of a familiar geometric figure — circle, square, star, etc. The way iron filings organize on a sheet of paper when a magnet is placed underneath demonstrates a good occurrence of continuity of discrete elements. Essentially, the planets in the solar system are arranged in terms of the forces operating on them producing good continuity.

11.38 **Closure.** Grouping by closure is similar to completing a jigsaw puzzle — that is, supplying the last of a series of discrete units to produce a meaningful whole. Closure provides a more complete and complex association than does good continuity. When a figure is closed, the parts are as fully lost to the meaning of the whole as are the lines, shapes and colors of a sunset. Closure is the result of continuous trial and simplification of an idea. It is arrived at when all the parts are necessary to the whole, no necessary parts are absent, and the general whole can be successfully transposed with a visual. For example, one of the most important closures in the world of science is Einstein's reduction of the

complexities involved in relating matter to energy and transposing this into the simple and now almost familiar formula, $E = mc^2$.

11.39 **2. Techniques for separating.** At the same time elements are grouped (see Fig. 11.4), segregation is occurring in terms of the following:

11.3.10 **Filled spacing.** The most obvious and simplest device for separating two elements is to place distance between them. However, unless the space between them is filled with heterogeneous material, the distant elements, particularly if they are similar, will be grouped despite the spacing.

11.3.11 **Contrast.** Any time a fundamental difference between two elements is intended, each should be visually presented with opposite features that are not only different, but enhance the actual difference. The usual contrasts are in color, brightness, shape, direction, position, size, texture, action, or surrounding. In color or brightness contrast, where one surrounds the other, the germinal beginnings of depth perception are apparent. The contained element will appear to be closer to the observer than the surrounding. This is largely because the total figure tends to be seen as figure and ground.

11.3.12 **Figure-ground.** Figure and ground perspective provides more interest to a visual; it may actually give the message the semblance of more depth. Since perception tends toward simplification, complex material can be arranged so that it falls into an easily recognized three-dimensional form. For example, material distributed only on the contour of a reversible figure such as the Necker Cube would be more compact and easily perceived than if it were placed irregularly in a shape that did not lend itself to three dimensions.

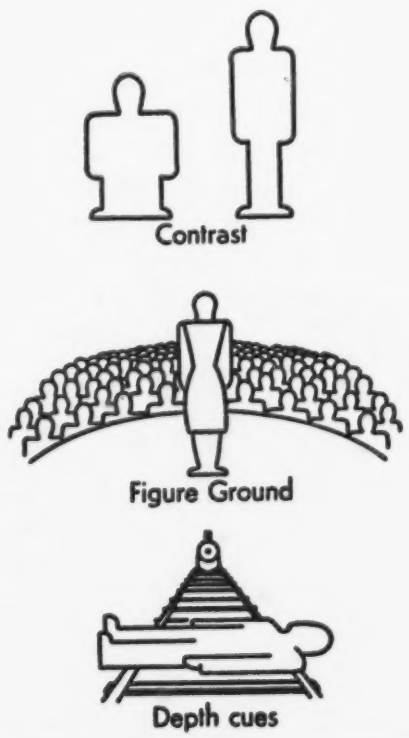


Fig. 11.4. Techniques of separating.

11.3.13 **Depth cues.** Most of the depth cues have been known for centuries. As described in the section on perceptual organization, they include overlap, the various perspectives, use of light and shade, movement, and distortion. Several are usually used in conjunction.

11.3.14 **3. Techniques for integrating.** Having grouped and separated the various elements, all should be integrated into a single, coherent visual. Effective visual presentations result from careful step-by-step planning. They start with a series of trial and error layouts, roughly sketched. The two important over-all considerations are to keep it *simple* and *clear*. Probably the best approach is to proceed "from above downward," which is to say, from the total idea to the specific parts. Essentially, all of the preceding principles of grouping and separating are relevant in producing a "good figure," or one that seems natural, fully articulated, persists in memory, preserves its shapes and colors, and communicates through proper transposition of idea to visual.

11.3.15 **Functional Considerations.** What functional effects do various elements have on the observer, particularly in terms of attention and mood?

11.3.16 **1. General techniques.**

11.3.17 **Attention-getting devices.** It is necessary to embody in visual communication a means of gaining the attention of the intended recipient of the message. In a sense, anything that is sudden, different, capsulating, or provocative draws the eyes of the observer.

11.3.18 **Verbal captioning and labelling.** One of the first places the eyes will rest is on any explanatory verbal areas of a visual presentation. We expect to obtain the "sense and essence" of the messsage from the caption. Disappointment results if the caption or label fails to produce the gist. Captions should be brief, and if possible, in telegraphic form. It is generally best to use only a few sizes and shapes for caption background elements and a limited number of letter styles and sizes. The caption in terms of the layout should bear a definite relationship to the total presentation.

11.3.19 Eye attractors. The mechanism of vision contains several "feedback" controls which produce attention in the presence of certain elements which have their origins deep in the evolutionary background of humans when sudden movement, animal colors, and other cues might mean sudden death. The following is a partial list of visual elements that "catch the eye."

11.3.20 Color. The use of color is perhaps the simplest and surest means of attracting attention. The attraction level of the color is related to vision physiology. Red, for example, will attract more attention than blue if the saturation and intensity of the two hues are equal.

11.3.21 Brightness. Although certain colors attract more than others, it is not the color but the brightness that is really effective. Attention generally is increased by the intensity of light and color. A certain brilliance of purple, for example, can gain more attraction than a duller red.

11.3.22 Movement. If the eye detects displacement of an object from one position to another, or if increasing distance between two objects is perceived, attention is almost invariably produced. Apparent motion can be in certain instances even more effective because of the illusionary quality.

11.3.23 Size. Anything large relative to its surrounding, or in general, will get attention. Size, therefore, depends to a large extent on the context and general frame of reference. A six-inch spider will capture more attention than a six-foot shark. Blow-ups are frequently used to gain attention.

11.3.24 White space. A surrounding of white space will bring attention to any object being surrounded.

11.3.25 Shape. Certain shapes and forms gain more attention than others. In general, asymmetrical, irregular shapes that also have the feature of simplicity are more eye-catching than duller, symmetrical and complicated ones.

11.3.26 Mystery. Presenting the visual communication as an unfolding solution can be an effective attention technique. A well-known car manufacturer, for example, attempted to produce interest in a new model by displaying it covered.

11.3.27 Content attractors. The meanings evoked by the content symbols produce attraction. Two important notes are that the level of attraction of content is more variable than the preceding devices and therefore less predictable, and most of the meanings evoked by symbols are learned. The symbols provide meaning simultaneously at three different levels:

11.3.28 Personal. The most difficult meanings to predict are those that are peculiar to an individual. These are built up through life experiences. One individual may be more sensitive to scientific material, another to artistic, etc.

11.3.29 Social. The group and community that one is related to frequently has its own level of sophistication, preferences and taboos. One can be sure that certain themes will be of interest to a wide variety of societies: achievement stories, adventure, mystery, and human relations, particularly those with sexual connotations.

11.3.30 Cultural. The broadest framework of content interest is of cultural matters. This essentially includes the broad issues of language style, format, and frankness of expression. It is enlightening for example, to compare the New York *Times* with the London *Times*.

11.3.31 Techniques for influencing mood. There is little reliable knowledge on the influencing of mood or mood induction with visual elements. In general, the problem is one of transposing the structure of moods into the visual structure. This requires an analysis of mood in terms of structure and relating this to the available visual elements. A simple illustration is the use of concentric spiralling inward used frequently on television to produce a mood of probing into inky mystery. Another one, easy to visualize, is the expansive structure of elation. Mood induction will be discussed in terms of line, object, and content.

11.3.32 Mood expressed by symbolic lines. All of us at one time or another have observed our own or someone else's "doodles." In these scribbles, it may have been noted, we *project* our feelings, and they tend to "look the way the emotion feels." Try a simple experiment with yourself. Experience an emotion or mood. Scribble spontaneously on a sheet of paper. Try this with several moods. You will find that although some are similar, they tend to be related to the *kind* of mood one is expressing — pleasant or unpleasant, serene or agitated.

11.3.33 In an exploratory experiment of this kind, subjects drew lines to indicate "love" and "hate," and they revealed some highly consistent representations. Disregarding such important elements as size and quality of line, the

doodles fell into a systematic pattern, as shown in Fig. 11.5. Love was generally drawn as a wavy line and hate as a jagged one.

11.3.34 Mood expressed by symbolic objects. Such experimental exploration into the nature of mood transposition suggests the possibility of constructing objects communicating moods by their combined color, shape, surface, material, and other object characteristics. The aim is to discover what variety of visual element is associated with what mood for a particular population. This latter consideration is important to note; continuous visual symbols, as is the case with any type of symbol, are always meaningful only in terms of a given cultural group.

11.3.35 The writer has had ten objects constructed in terms of observed associations between visual elements and mood, which seem to hold true in our culture. These objects are shown in Fig. 11.6. From 70 to 75 percent of the subjects could detect the mood projected into the object by correctly matching object with mood. Even without color, matching was 62 percent accurate. The implication is that with the compilation of such data it becomes possible to construct visuals with predictable mood induction qualities installed.

11.3.36 Mood expressed by content. The most reliable technique for evoking mood is through concrete inclusion of mood-laden material, pictorial in nature. Everyone is familiar with the fact that a sad face evokes similar expression in observers through a process known as *empathy*, a putting of oneself into another. In such instances, it is possible to identify oneself with, for example, the hero in a movie. Fig. 11.7 shows a highly integrated early cave painting of a bison with striking dynamic mood properties,

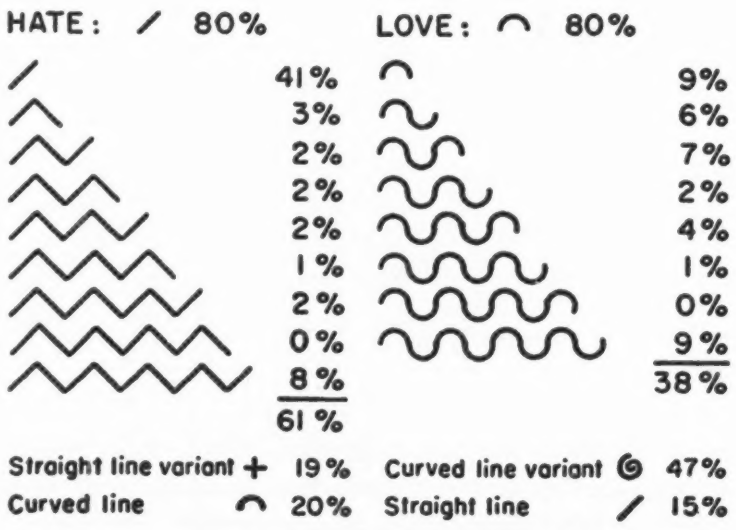


Fig. 11.5. Expression of feeling in line.

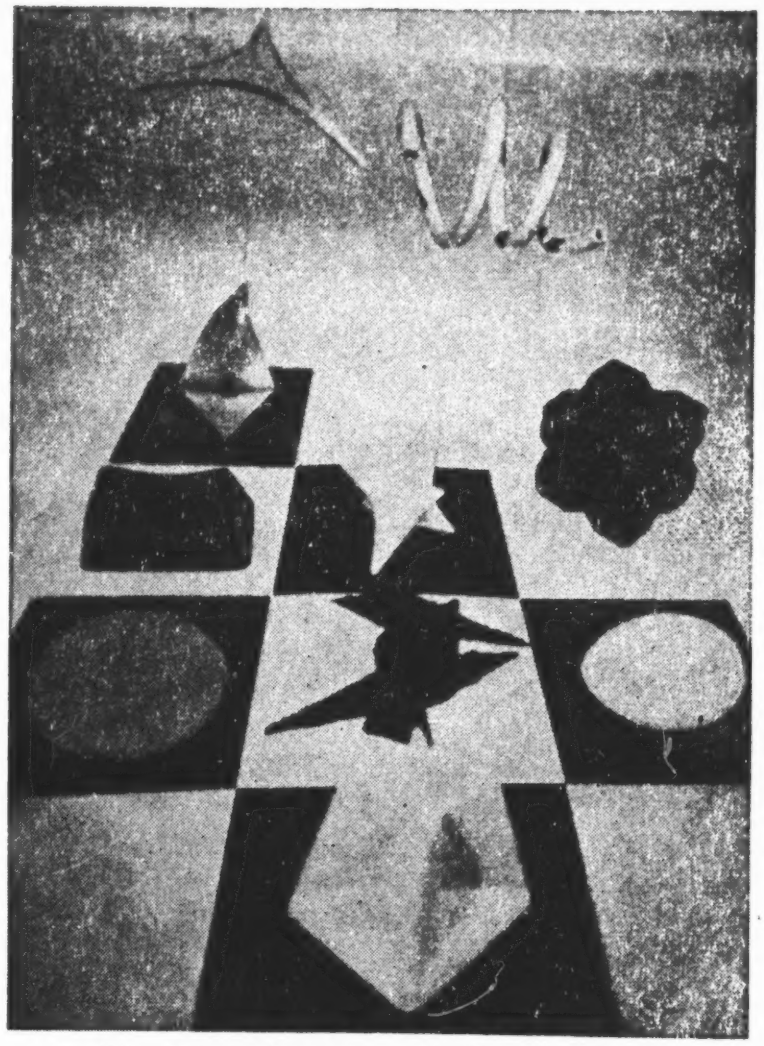


Fig. 11.6. Expression of feeling in objects.

revealing how basic empathic feelings are in humans.

11.3.37 2. Achieving Visual Communication Purposes. There are a variety of techniques for achieving the five general purposes of

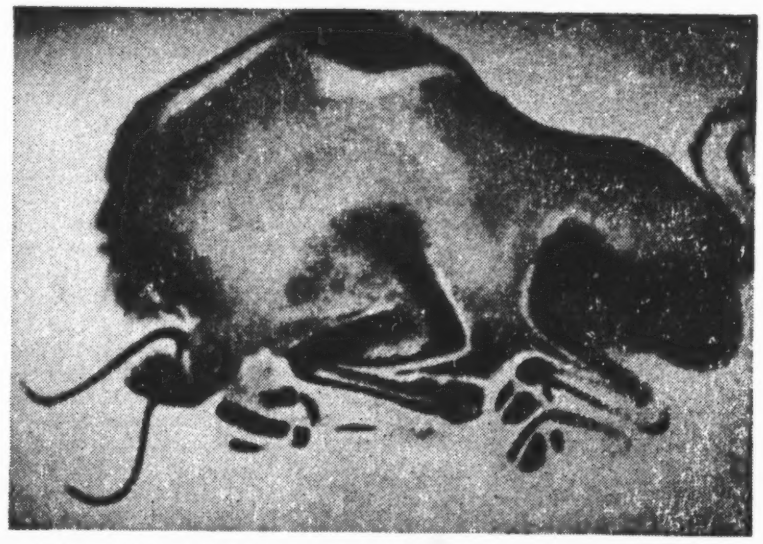


Fig. 11.7. Charging bison from a painting perhaps 20,000 years old from the caves of Altamira (from L. Hogben. *From Cave Painting to Comic Strip.* Chanticleer Press, New York, 1949).

communication: identifying, characterizing, evaluating, prescribing, and relating.

11.3.38 Identification. An object can be identified in three different ways: The *object* itself can be shown, its familiar *environment* can be shown, or a *substitute* symbol can be used, such as a trademark. See Fig. 11.8.

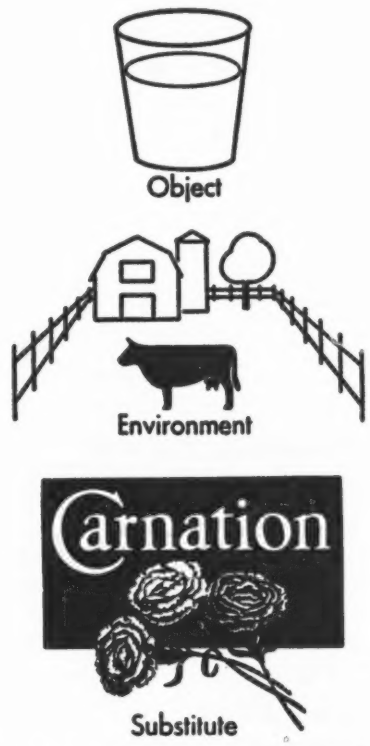


Fig. 11.8. Identification techniques.

11.3.39 Characterization. When features of the object are to be characterized the usual techniques include showing a *closeup*, a *plan* drawing, or a *quality* (see Fig. 11.9).

Fig. 11.9. Characterization techniques.

11.3.40 Evaluation. Objects are usually evaluated in terms of *negative-positive* and *means-ends* relations (see Fig. 11.10).

Fig. 11.10. Evaluation techniques.

11.3.41 Prescription. Visual requests are frequently made by showing the results of obeying the prescription in comparison to before —a *before-after* presentation, or by visually outlining *instructions*, or simply by presenting *mandatory* signs, such as "Keep Out." (See Fig. 11.11).

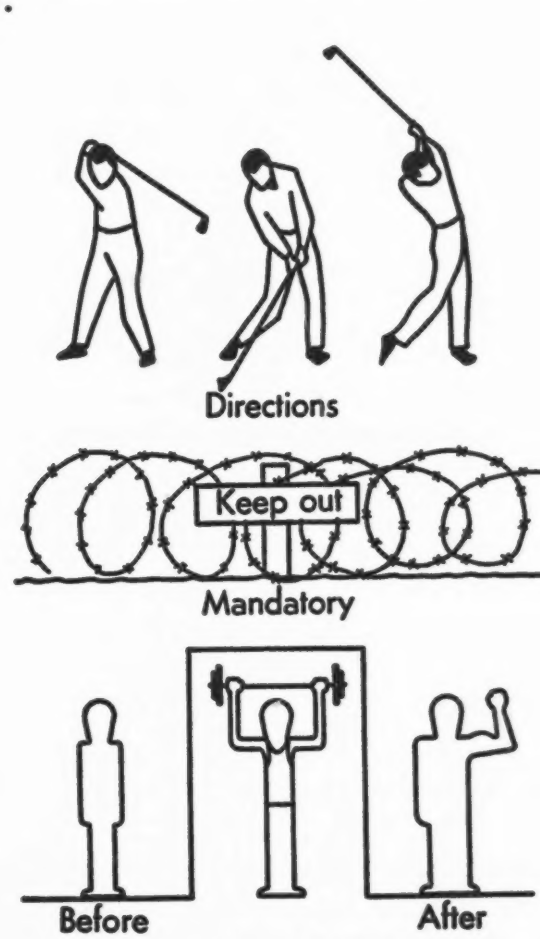


Fig. 11.11. Prescription techniques.

11.3.42 Relation. There are a variety of graphic techniques for relating objects to others. Fig. 11.12 shows some common solutions to graph problems.

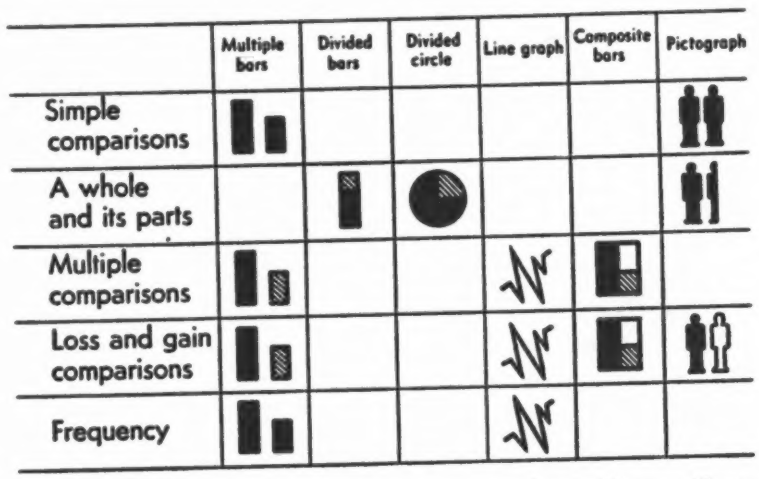


Fig. 11.12. Solutions to common graph problems (from Bower, T. E., "Graphics in Communication," *Journal of the American Society of Training Directors*, June, 1959.)

11.4 Adequacy and Visibility of Sensory Design

11.41 Assuming that all of the major problems involved in visualizing and applying structural and functional principles are achieved, a final problem remains: How adequate is the design? Frequently, excellently produced visuals fail because someone overlooked elementary details, such as the proper size of elements, their positioning, or improper captioning. The adequacy is largely effected by first, the number, size, positioning, brightness and color contrast of the constituent elements, and second, by the major overall characteristics — the speed of recognition, the degree of comprehension, its general efficiency, visibility, degree of fatigue produced, and its attractiveness.

11.42 Size of Elements. After determining the number of elements that will be included in the visual from the layout, the question of size is important. There are two important classes of sizes: the over-all *field*, and the included *elements*. The size of the over-all field in most instances should be estimated first. This depends on such considerations as:

1. The probable distance of most viewers.
2. The average length of time of perception, since, in general, the shorter the viewing time the larger the visual should be.
3. The degree of portability needed of the visual.
4. The material that will be used.
5. The economic use of standard sizes of various materials.
6. The probable lighting conditions.
7. The general visual acuity of the prospective audience.

11.43 The size of the elements, particularly small ones such as lower case lettering, frequently presents a problem in estimating size. The most direct means would be to try a few sizes and evaluate from the expected viewing distance and lighting. This can be exceedingly tedious and wasteful if a great number of estimates must be made, for example, such as the placement of many elements in an exhibit or along a road.

11.44 A simple instrument, which can be called a "visibility meter," can be constructed and used in such instances. It is based on the visual angle idea and formula of Fig. 7.30, involving the estimation of the size of the retinal image. The visibility meter is illustrated in Fig. 11.13, along with the geometric characteristics involved.

11.45 For example, if the desirable size for the letters of a sign "Exit" is to be determined from a particular position, the following procedure is followed:

1. Print in small letters the word, "Exit" on a transparent plastic square (A), approximately 2" x 2".
2. Place the plastic square in the holder (B) and head on the chin rest (C) of the stationary platform (D).
3. Slide the holder containing the "sign" to or away from you (E) while positioning the holder through the sight (F) to the place where the sign is to be.

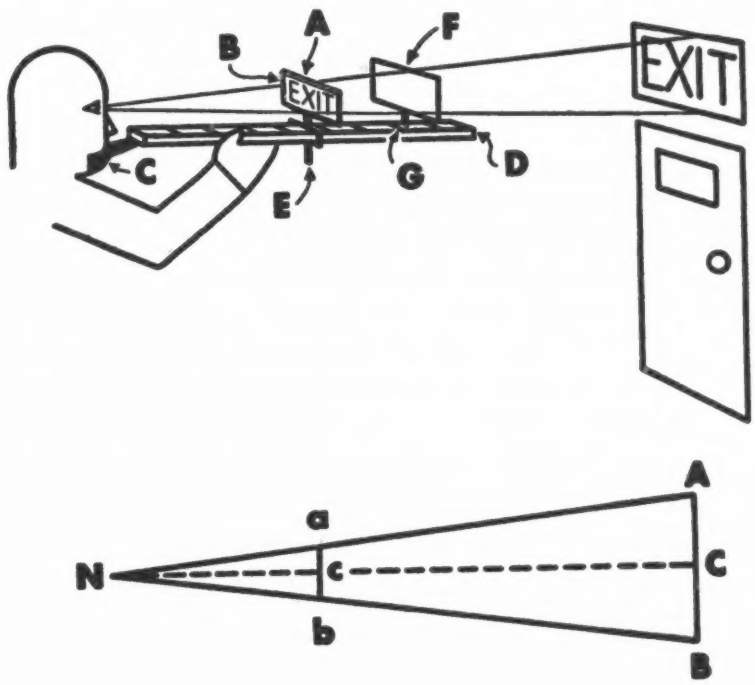


Fig. 11.13.5. Visibility meter.

4. When the sign seems to be at about the right size, the position of the sign along the graduated platform (G) will indicate how far the sign is from the viewer's eye.
5. If the size of the letters on the plastic square and the distance of the eye to the sign and to the position on the area where the wall will be are known, it is possible to compute the approximate size that the size should be by the following simple proportion:

$$\frac{\text{Size of element required for visibility}}{\text{Size of element in Visibility meter}} = \frac{\text{Distance of eye to element in Meter}}{\text{Distance to proposed place of element}}$$

or, according to the geometric analysis in Figure 16, simply

$$\frac{AB}{ab} = \frac{Nc}{NC}$$

Of course, AB, or the size of the element desired for visibility or other purposes, is what must be solved for. As an example, if I used a 1-inch letter height and it appeared at a desirable height on a wall 12 feet (or 144 inches) away when the letters were 12 inches away, the size of the letters should be approximately 12 inches:

$$\frac{x''}{1''} = \frac{144''}{12''}$$

$$\times = \frac{144''}{12''} = 12''$$

11.46 Number of Elements. A simple rule pertaining to number of elements is to keep them to a bare minimum. Of course, too few elements may defeat the communication's intent. For every communication problem there is an optimal range of elements. Unnecessary additional elements dilute the message, since attention is spread thinner by the additional elements. In determining the number of elements the following should be carefully considered:

1. The complexity of the message. Generally, the more complex, the more components are necessary to depict relationships, although this is not always true.
2. The degree of solution of the problem being communicated. In general, the more resolved, the less elements are needed.
3. The level of understanding of the audience, their general background and knowledge.
4. The level of understanding that is desired by the communication.
5. The availability of material.
6. The amount of time that will be spent in viewing.

11.47 In a recent study, the writer flashed sentences of various lengths (from seven to ten words) to subjects, who then wrote down the words they saw. This type of experiment, using a *tachistoscope* (an instrument for flashing material rapidly) simulates the actual life condition of glimpsing for fractions of a second various communications seen along roads or in the daily newspaper. The results indicated graphically in Fig. 11.14 that the number of correctly identified

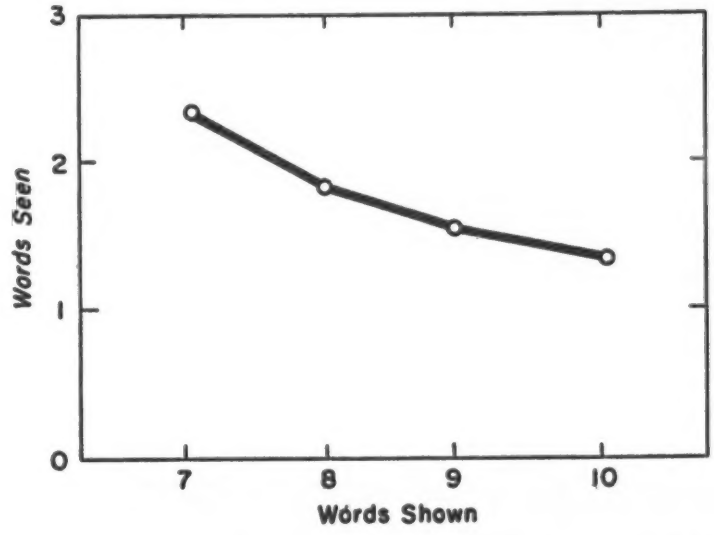


Fig. 11.14. The number of words seen in terms of the number of words flashed at one-tenth second.

words depend on, among other things, the number of words shown. In general, the more words shown, the fewer absolute words correctly seen. Under the conditions of this experiment, subjects were able to see one-half more words when seven were shown than when ten were shown at the same exposure.

11.48 Positioning of Elements. There has grown a large body of scientific information identifying the areas most frequently looked at. This is vital information to newspaper advertisement, for obvious reasons.

11.49 The most elaborate technique for identifying these areas is with the use of eye-movement photography, where the saccadic movements of the eye over printed material can be permanently recorded on film for further study. It is rarely necessary when preparing simple visuals to become this involved. There are, however, simple principles that should be noted:

1. The eye most frequently tends to look at the upper center of presented material.
2. Informal off-centering of elements — that is, asymmetrical balancing, is more interesting than dead centering.
3. Major elements, such as captioning, should be clearly segregated from minor elements.

4. Minor elements, in general, should be so arranged as to lead the eye either to or away from major elements.
5. Major and minor elements should be interdependent — that is, neither should seem complete if alone.
6. The various elements derived from the layout should be arranged in various positions until an interesting pattern is produced.

11.4.10 The simplest instrument to determine the effect position has on visibility is the tachistoscope. It is possible to build a simple one as illustrated in Fig. 11.15. By releasing the

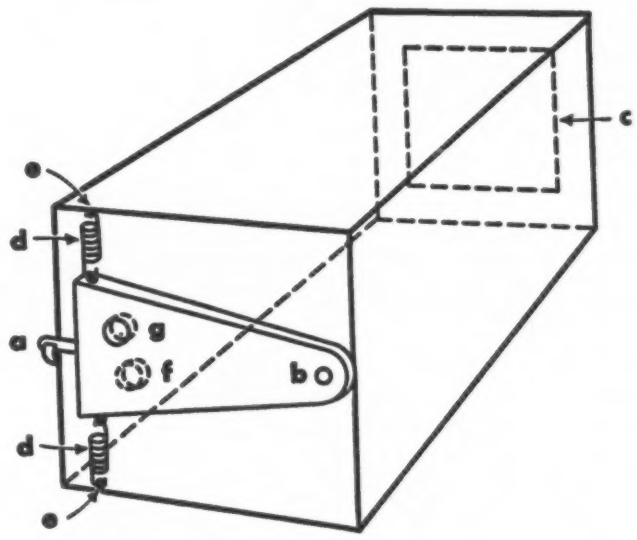


Fig. 11.15. Home made tachistoscope or flash meter.

switch (a) the movable section, hinged at (b), containing a hole (g) about 1 inch in diameter passes over the stationary section, containing a similar hole (f) and for a fraction of a second, material positioned at (c) can be tachistoscopically viewed. Rubber bands or springs (d) and the distances from where they are bolted (e) determine the speed of the shutter opening. The shutter blade has to be reset after each use.

11.4.11 **Brightness and Color Contrast.** The most effective means for separating elements and producing attention is through the means of brightness and color contrast. Color is one of the most important elements in any successful display; it plays an important role in evoking mood. A group of meat markets recently painted their walls blue-green and used green sawdust in order to increase the redness and brightness of their meats.

11.4.12 Something about the psychological characteristics and effect of color may be useful in this context. Research shows that there is a greater preference for hues of either high value difference or low value difference, rather than medium value difference. Cool colors are generally preferred for backgrounds and warm colors for foregrounds. Several investigations have shown the following hierarchy of color preference, from most to least preferred: red, blue, violet-blue, violet, green-blue, green, violet-red, blue-violet, red-violet, green-yellow, orange, orange-red, yellow-orange, yellow, orange-yellow, and least, yellow-green. It was also found that preference is affected first by hue, second by value or darkness, or lightness, and last by saturation.

11.4.13 These findings, however, can frequently be misleading, because they are out of context. The preferred colors for ice cream or sunset obviously depend on the situation. Some studies have been more specific. Yellow and orange, for example, are preferred for publicity on building materials, yellow and green for beverage advertisements, and amber tooth brush handles for those in the upper economic brackets (red for the lower economic brackets).

11.4.14 Research in color association has shown that the reactions are not random. In such studies, light colors are almost invariably described as breathlike and pale, dark colors as gloomy; red-orange and yellow are never associated with cold and blue never with warm; cheerfulness is hardly ever associated with gray, white, or black. Many of these associations are of course artificially developed in society. Purple for royalty is a Western idea. Many colors have conflicting meanings — white, for example, may mean either death or life.

11.4.14 There have been many attempts to codify color meanings in industry. Noteworthy is the Safety Color Code devised by the American Standards Association: red for fire, danger, and stop; orange for dangerous areas; yellow or green for caution; green for safety; purple for radiation; and black and white for traffic. Color can also affect the experience of temperature. There is usually a marked decrease in requests for heat in cold climates when warm colors are added to walls and décorations.

11.4.15 **Specific Graphic Characteristics.** There are five major variables for consideration in terms of graphic adequacy. Each of these will be discussed with methods for evaluation of adequacy, particularly typographic adequacy.

11.4.16 **1. Speed.** How fast is the material perceived or recognized is an initial but far from the most important consideration. With

typographic material such as newspaper print, estimates of speed or *rate* of reading can be computed, usually in words per minute (wpm). Although the rate of reading varies widely, the average person reads between 200 and 225 wpm. If time is a consideration, verbal material of an average degree of difficulty and even under ideal conditions should be presented to a group at about 100 to 150 wpm. Nonverbal, or continuous material, is somewhat more difficult. The simplest approach would be to obtain estimates of the length of time individuals require to "read" the visual. In general, simple, regular geometric forms are perceived more quickly than irregular ones.

11.4.17 2. **Comprehension.** More important than speed is the amount of material understood. Methods for estimating comprehension range from simple, informal check questions, to standardized reading tests. It is always desirable to obtain an estimate of the percent comprehension that can be expected from a given passage or other visual presentation.

11.4.18 3. **Efficiency.** The product of speed and comprehension yields probably the most reliable estimate of visual adequacy. If, for example, a passage is read at about 200 wpm and a standard test of the reading indicates that 50 percent of the passage was comprehended, the reader then has an efficiency rate of 100 wpm. With nonverbal material, an estimate of the number of elements perceived per given unit of time would indicate the efficiency of the visual.

11.4.19. 4. **Fatigue.** Different visual materials produce varying degrees of fatigue. Reading speed, for example, decreases with continuous reading. Fig. 11.16 indicates the actual decrease in speed in the reading of a passage. The passage was divided into quarters and an estimate of speed was obtained for each quarter. Reading deceases rapidly at the beginning and levels off to a fairly constant pace. Fatigue can also be estimated for nonverbal material. Everyone recalls having seen a movie or television production that greatly tired the eyes. One method

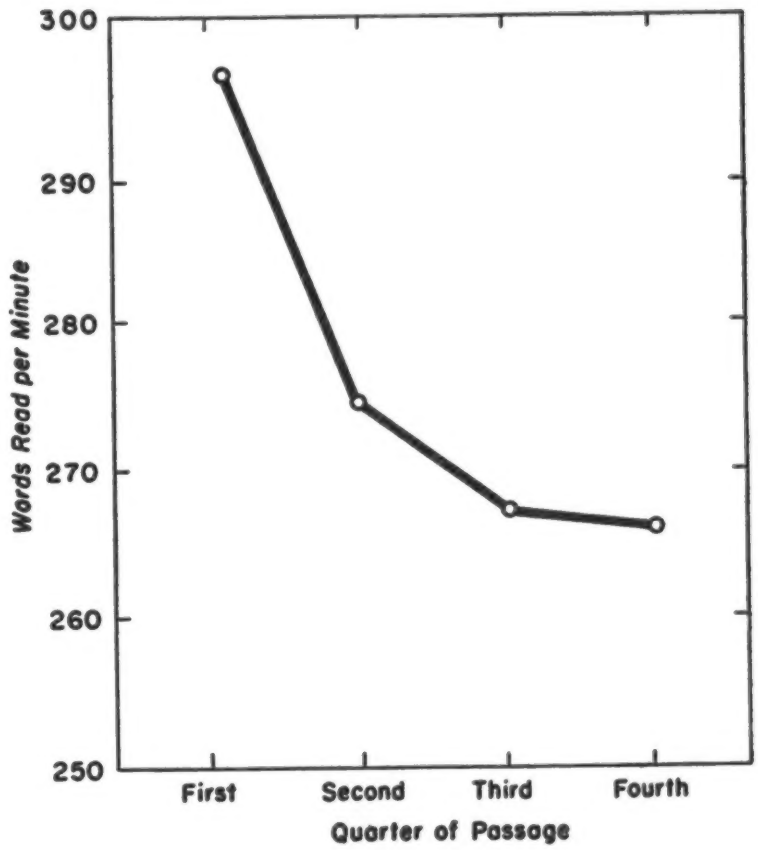


Fig. 11.16. Decrease in reading speed produced by fatigue.

of estimating this, suggested by Luckiesh, is to count the eye blinks per minute, since the frequency of eye blinking is related to fatigue.

11.4.20 5. **Preference.** A final consideration is the aesthetic qualities of the graphic. Aesthetic factors are important for two important reasons. First, aesthetic qualities attract attention and the material is retained longer. Second, and most important, by incorporating, for example, informal balance, good development or rhythm, and harmony, the material is more quickly perceived, more easily comprehended and, therefore, generally more efficient and less fatiguing. Because of the personal nature of preference and the wide variety of taste, it is difficult to obtain measures of preference. When such measures are obtained, they are usually through some system of rating or ranking.

12. Selection and Use of Visual Media

prepared by Robert C. Snider

12.1 The Language of Vision

12.11 Words are not enough. Despite our interest in visual communication, all of us must approach this subject under the same serious handicap, for ours is an almost completely word-oriented society, and we are products of this society. Obviously, the most frequently used channel of communication in our society is verbal, either spoken or written. The implication here is not that we have given too much emphasis to verbal communication. Rather, it would seem, we have not given adequate attention to the various modes of visual communication.

12.12 Earlier in this book, it was stated that, from a psychological point of view, the creative process and the process of visualizing are practically synonymous. This implication that words are inadequate for imaginative, creative thought, is made even more succinctly by Louis H. Sullivan who said, "Real thinking is better done without words than with them, and creative thinking *must* be done without words. When the mind is actively and vitally at work, for its own creative uses, it has no time for word-building: words are too clumsy: you have no time to select and group them. Hence you must think in terms of *images*, of pictures, of states of feeling, of rhythm. The well-trained, well-organized, well-disciplined mind works with remarkable rapidity and with luminous intensity; it will body forth combinations, *in mass*, so complex, so far-reaching that you could not write them down in years. Writing is but the slow, snail-like creeping of words, climbing, laboriously, over a little structure that *resembles* the thought: meanwhile the mind has gone on and on, here and yonder and back and out and back again."

12.13 In his discussion of what is said and how it is said, substance and form, John Dewey lends support to the assumption that visual media are unique in that they cannot be translated into words without a loss of meaning: "Because objects of art are expressive, they are a language. Rather they are many languages. For each art has its own medium and that medium is especially fitted for one kind of communication. Each medium says something that cannot be uttered as well or as completely in any other tongue. The needs of daily life have given superior practical importance to one mode of communication, that of speech. This fact has unfortunately given rise to a popular impression that the meanings expressed in architecture, sculpture, painting and music can be translated into words with little if any loss. In fact, each art speaks an idiom that conveys what cannot be said in another language and remain the same."

12.14 A most helpful way of giving thoughtful consideration to visual communications media will be for each of us to test frequently Dewey's position that each art medium is a unique language capable of making statements that it would be impossible to articulate as effectively through any other medium. Our testing of this concept, of course, can range from actually using a variety of media for a given purpose with several audiences to simply a hasty mental appraisal based on past experience with various media. In either case, the essential thing is our willingness to try something new, to experiment, to be constantly alert to ways of improving our communication technique. The imaginative teacher is the interesting teacher — and without interest there can be little real learning.

12.15 Although Dewey speaks of "art," we must keep in mind that when the above quotation is considered in the full context of his work, Dewey's interpretation of the term art, as used above, is certainly broad enough to include the visual media to which we have addressed ourselves. It must be remembered that for every visual statement created today as a work of art, many thousands are created simply to convey visual information.

12.16 There is, indeed, a real danger that the novice will confuse the field of aesthetics and fine art with the more practical, utilitarian functions of visual communication. Aesthetics has traditionally been considered one of the philosophic disciplines concerned with theoretical exploration of questions that arise when men reflect on the beauty of nature and the products of fine arts. The primary interest of the artist, of course, is in creating objects of beauty without a thorough and systematic concern for the communication effects of his product.

12.17 The communication specialist, on the other hand, is primarily concerned with meaning and concerned with form only as it can contribute to that meaning. Anyone working creatively with visual media is apt to find himself torn between theoretical, aesthetic considerations of art on the one hand, and the much more empirical considerations of the science of communication on the other. Perhaps this question can best be resolved if we consider ourselves first and foremost as communication specialists with an interest in art forms only as they can clarify our message.

12.18 Historically, visual forms of communication have played a little-noted but essential role in the development of our present-day civilization. In a series of eight lectures at the Lowell Institute of Boston in 1950, Ivins developed this significant point. "Although every history of European civilization makes much of the invention in the mid-fifteenth century of ways to print words from movable types, it is customary in those histories to ignore the slightly earlier discovery of ways to print pictures and diagrams . . . the printing of pictures, however, unlike the printing of words from movable types, brought a completely new thing into existence — it made possible for the first time pictorial statements of a kind that could be exactly repeated during the effective life of the printing surface. This exact repetition of pictorial statements has had incalculable effects upon knowledge and thought, upon science and technology, of every kind. It is hardly too much to say that since the invention of writing there has been no more important invention than that of the exactly repeatable pictorial statement."

12.19 The invention of photography, scarcely more than a century ago, with the subsequent flood of techniques for reproducing all kinds of visual materials has greatly increased not only the quantity but the types of visual messages and the purposes to which they have been put.

12.2 Photography

12.21 Because of its several uses in many obviously unique communication media, it will be convenient to consider photography as a kind of language; a language that is communicated through a number of quite separate media, *e.g.*, snapshots, newspapers, posters, slides, and motion pictures. The use of photography as a means of communication has only recently reached significant proportions and it has yet to develop its full potential.

12.22 Discussing consequential forces in contemporary society, Moholy-Nagy says: "It is unprecedented that such a 'mechanical' thing as photography — regarded so contemptuously in the creative sense — should have acquired in barely a century of evolution the power to become one of the primary visual forces in our life. Formerly the painter impressed his vision on his age; today it is the photographer."

12.23 Whiting has described photography as a means of communication that enables man to show instantly the appearance of all things more accurately than vision itself. A newly invented language, photography is capable of transmitting information simultaneously to Scots, Russians, Egyptians, Kansans, Filipinos. This form of fact-transmission, or expression, despite its realism and all-encompassing sweep of detail, can also be used selectively to draw comparisons and to register social protest. Photography is now being used so widely that much of the information in the mind of virtually any civilized person is picture information.

12.24 Selectivity is indigenous to any use of photographs in communication. First of all, anyone who "takes" a picture must by this very act exercise a great deal of selectivity in terms of time and space, angle and focal length, light and shadow. Most photographers "shoot protection," that is they make several exposures of whatever they happen to be photographing, and thus they are able to exercise another degree of selectivity in deciding what negatives they will print and what negatives they will discard.

12.25 After the photographer passes his selection of prints on to his client, be he editor, producer, or county agent, this person will in turn have to make choices from the pictures he receives, sometimes from many photographers. His choices will be made in terms of his purposes, his understanding of his audience, his ability to judge pictures in this context, and his budget.

12.26 Final selection is always made by the viewer who, when confronted with the picture, must decide how much attention he will give it. Professionals who work regularly with photographs make every effort to obtain many pictures from which their selections can be made.

12.27 Magazines such as *Life* and *Look* often work with a "shooting ratio" of 1,000 to 1. "Shooting ratio" refers to the ratio between the number of photographs taken for a particular story and the number of photographs eventually printed. A higher ratio will result in a more effective photo communication provided two important conditions are met: (1) The number of photographs available for our selection or "editing" must provide us with a variety of treatments and points of view of the subject being pictured. (2) It is essential that the final selection of photographs be made with a clear understanding of our communication objective and our audience.

12.28 Obviously, this kind of an activity requires a skill that perhaps can best be appreciated after we have had some experience in selecting the three or four most effective pictures for a given purpose from an assortment of several thousand prints (or even several hundred) of the same activity. Whether we are taking pictures, using pictures, or both, our success will depend in large measure on our ability to judge photographs for a well-defined objective. On the other hand, if we are unable to define this objective, we should seriously question the decision to use a photograph, for we all too often find photographs being used as part of a communication for no apparent reason whatsoever — uncommunicative, indifferent images.

12.29 **The Photographer.** Nearly everyone in visual communications will find himself using a camera at some time or other. The question of how proficient the visual specialist should be with a camera will depend on many things including his own inclination to work with a camera.

12.2.10 The statement has been made that "the photographer who is only a photographer isn't a photographer." Stated in other words, this refers to the importance of a photographer's understanding the subject-matter he is to photograph. It almost goes without saying that our understanding of a subject will be reflected in the photographs we make of that particular subject. Some photographers have specialized in a subject and have become quite successful not simply because of their skill as photographers, but because of their photographic skill *plus* their knowledge of and interest in the subject.

12.2.11 The better a photographer understands his subject, the better his pictures will be of that subject. This simple but often overlooked fact is important to keep in mind not only when we take pictures, but when we engage a photographer to do a job for us. W. Eugene Smith, well-known *Life* photographer, goes to great lengths to know his subjects well before his photographic activities.

12.2.12 In preparation for doing his "Nurse Midwife" story (*Life*, December 3, 1951), Smith took a two-week midwife training course before he made a single picture. He became steeped in his subject and accompanied a nurse midwife on all her calls in the backwoods around Pineville, South Carolina, until he became a familiar figure in the countryside. When Smith went to Spain to do his now famous "Spanish Village" picture essay (*Life*, April 9, 1951), he did not unpack his cameras for weeks. "Instead, he read many books on Spain's culture and politics and drove nearly 7,000 miles around the Spanish countryside until he had soaked up the moods and atmosphere of Spain and her people."

12.2.13 **Cameras.** "You push the button, we do the rest." This 1888 camera slogan was never more true than it is today when cameras of every size, price, and description are available for making black-and-white, color, and even three-dimension pictures in the form of prints, slides, or motion pictures. Cameras and camera equipment have kept pace with the automatic gear shift and the automatic washing machine. Today your approach to the mechanics of photography, like your approach to the mechanics of the automobile, can be as simple or as complex as you want it to be.

12.2.14 Much detailed information about cameras is available in great quantity from camera shops, manufacturers, and many books, booklets, and magazines dealing with many phases of photography. So much material is available, in fact, that it is apt to be confusing to the novice. It will be well to remember that simply buying the most expensive camera you can is not always the best plan. If you lack experience you may find it too complex for your purposes. The novice will most likely do his best work with a less complicated, inexpensive camera.

12.2.15 Once you have a camera you will be tempted by the photographic pitfall of gadgets. You will at once be confronted by a bewildering array of tripods, flash guns, reflectors, lens shades, filters, cable releases, range finders, extra lenses, and exposure meters — to

mention only a few. Don't be confused. Remember, your first job is to learn to use your camera which will make good pictures just as it is. Get attachments only when you have learned to understand their function and how they can help you do a better job.

12.2.16 Exposure meters, incidentally, are important, but they are as difficult to use properly as many cameras. Beginners can and do get good exposure results by following the instructions packed with every roll of film or by using inexpensive cardboad exposure guides available at all camera shops and many drug stores.

12.2.17 As the *how* of camera operation becomes second nature, you will be able to concentrate on the much more important problem of *what* to photograph. Keep in mind that the camera is only an extension of your vision. It will capture an instant of time at your bidding. *Cameras, like typewriters and paint brushes, are significant only in terms of what is created with them.* The difference between snapshots and really effective photographs will often be determined by your ability to see pictures in the world around you. It matters little what kind of a camera is used to "take" these pictures. Finding them is the important thing.

12.2.18 As you take pictures keep in mind how you will use them later. What pictures will best tell the story you want to tell? Study published photographs to stimulate your thinking about how and what you will photograph. Have a plan for the pictures you want to make. You may not be able to follow this plan, but thinking about it will increase your ability to "see" pictures that will be of value to you in the future. Take enough pictures. Be in a position to show only a selection of your pictures. No writer publishes every word he writes and no photographer exhibits every picture.

12.3 Words and Pictures

12.31 Although we usually consider visual communication as a separate, somewhat unique, nonverbal mode of evoking meaning, an examination of current practice in the visual media of communication will quickly reveal the important fact that these so-called visual media seldom operate completely without some kind of verbal accompaniment. According to Elizabeth McCausland, "A conception needs to be developed to distinguish between the content which language conveys and the content which pictures convey. The Chinese aphorism that one picture is worth ten thousand words is simply a rationalization of the illiteracy of millions of Chinese."

12.32 This matter is discussed by Wilson Hicks: "There are those who believe there is a bright future for extended statement in still photography without the aid of words. From the photojournalistic standpoint, this view is not sound. The wordless picture story, narrational or expository, is, and will be, the exception. The point is not whether photographs can get along without words, but whether, with words, they can perform their own function better. . . . The photograph does not always tell how an emotion was caused, what its effect will be later. Of a man of forty, unless he has been a subject of detailed photobiography through the years, the camera cannot say what he was like when he was ten years old, or what he had for breakfast this morning, or what train he will take tomorrow. *So it becomes the duty of words to provide the facts of before and after* . . . the camera can go just so far. Words go the rest of the way."

12.33 It is of some interest to note the relative importance of words and pictures in verbal-visual presentations such as illustrated lectures, captioned filmstrips, illustrated displays, or even sound motion pictures (although the latter are unique in many respects). In commenting on their relative importance Hicks tells us that "pictures and words together perform a more effective function than either can perform alone. There can, however, be an inequality in their communicative values, the value of each medium being the clarity, coherence and force with which, in its own way, it says something about a given subject. In some instances the picture can have a value in excess of the accompanying words; in other instances the opposite can be true. The ideal is reached when the values are equal and in balance, for then the single expressive statement has maximum impact."

12.34 Even when words and pictures are combined so as to reach their "maximum impact" as described above, according to students of this phenomenon, they have still not accomplished all of the communicative potential of this form of communication. According to Hicks "the very foundation of the form rests on its extraordinary ability to induce a phenomenon wherein the total of the complex — that is, picture and words together — becomes greater than the sum of its parts. This phenomenon is caused by the addition of an X factor to the joint impression made on the reader's mind by the mediums acting in concert, the X factor being the reader's own contribution to the communicative chemistry.

Appealed to through eye and ear, his emotional or intellectual reaction doubly stimulated; the reader supplies material from memory and imagination to round out and enrich what is being conveyed to him."

12.35 Captions have been referred to as verbal fingers pointing at pictures. Newhall feels that most people need verbal crutches to see with, although she feels that the number of people for whom really great photographs speak a language beyond words is steadily increasing. Newhall further points up the significance of the caption when she says, ". . . the most explicit photograph may not reveal to the most omniscient eye of editor or historian the precise place and day it was made. Therefore the association of words and photographs has grown to a medium with immense influence on what we think, and, in the new photograph-writing, the most significant development so far is the *caption*."

12.36 In considering the viewer's ability to identify the content of a visual field — what is in the picture — psychologists tell us that naming the objects in a picture is an early essential to the development of perception in children. Indeed, many adults feel they have exhausted the meaning in a pictorial statement if they can assign words to its content. We often remember the caption when we think we are telling someone about a picture we have seen in a magazine or filmstrip. Identification of content is, of course, much more than this, and it need not be limited to verbal identification. It can, and often is, identification with our personal categories of past experience — it may be an emotional, cultural, or aesthetic identification that will often defy verbal description.

12.37 A considerable amount of research has been published on the influence of words on the meanings conveyed by pictures. Kerrick found that captions can modify the judgments of readers regarding the pictures they accompany, and may even change interpretations. This investigation provides evidence that a caption will tend to cause a significant general modification of judgment regarding the picture it accompanies. Also, that it is possible for a caption to cause a complete change in interpretation, so that, for example, a picture which is usually judged a "happy" picture, will be judged a "sad" one.

12.38 Kerrick's findings further indicate that, for the most part, the influence of a caption can be anticipated by the writer of the caption. "In some instances, however, the caption may cause an interpretation directly opposite to that desired by the caption-writer. By and large, captions which suggest meanings incongruent with the content of the picture will be rejected, and interpretation will be primarily a response to the picture alone. This is by no means always true, however."

12.39 Early investigators of what we now call captions noted the tendency of subjects to label or name pictures as an aid to reproduction of those materials. Luchins demonstrated that labels applied to relatively ambiguous designs will aid recognition of the outline of objects concealed in the design. Subjects examined the drawings for characteristics compatible with the label applied. That characteristic, for some subjects, became the only aspect of the design to which they attended. Carmichael and others found that the label applied to an ambiguous design in many cases determined the reproduction of that design. Farmsworth and Beaumont demonstrated that aesthetic evaluation of little-known paintings was significantly affected by a statement of the commercial value of the paintings. McGranahan states that, "The effect of language on perception appears to be to make those features of the objective world that are represented by linguistic forms stand out in greater articulation, to cause similarities to be seen in things similarly represented and in general to influence perception in the direction of the speech forms." Vernon points out that although we have no actual experimental evidence of the fact that we tend to perceive most readily that which we can name most easily, there are a number of studies that suggest this may be so.

12.3.10 In her provocative discussion of the caption, Newhall describes the following differences between *title*, *caption*, and *text*, in relation to pictures:

Title: (Photographic usage, in the United States) An identification, stating of whom or what, where and when a photograph was made. A title is static. It has no significance apart from its photograph.

Caption: Briefly stated information, usually occupying no more than four short lines, which accompanies a photograph, adds to our understanding of the image, and often influences what we think of it. A caption is dynamic; it develops title information into why and how along a line of action. It makes use of the connotations of words to reinforce the connotations of the photograph. It loses half its significance when divorced from its photograph.

Text: Main literary statement accompanying a series of photographs, usually presenting information about the theme and its background not contained in photographs and captions. Text, no matter how closely related to photographs, is a complete and independent statement of words.

12.3.11 At a later point, Newhall identifies four main forms of the caption, which she calls: *The Enigmatic Caption, The Caption as Miniature Essay, The Narrative Caption,* and *The Additive Caption.* Her discussion of these caption-types follows:

"*The Enigmatic Caption* [is] a catchphrase torn from the text and placed under a single photograph. The sequence of interest runs like this: the eye is caught by the photograph, then by the caption, and then the irritated owner of the eye finds himself, hook, line, and sinker, compelled to turn back to the attached article and read it. This type is found in full classic purity in *Time.*

"Then there is the *Caption as Miniature Essay.* This again usually accompanies a single photograph and comprises with it a complete and independent unit. *Life's* 'Picture of the Week' and 'What's in a Photograph?' series offer examples, and any glance at any *Illustrated London News* will provide dozens more. (It is probably the most ancient form of caption; it has survived since the monumental bas-reliefs of Babylon and wall-paintings of Egypt.)

"*The Narrative Caption* is, of course, overwhelmingly the common contemporary form and is familiar to everybody through magazine journalism. It directs attention into the photograph, usually beginning with a colorful phrase in boldface type, then narrating what goes on in the photograph, and ending with the commentary. In a photo-story, it acts as a bridge between text and photograph.

"*The Additive Caption* appears to be the newest form, risen into prominence to answer a new need. It does not state or narrate some aspect of the photograph; it leaps over facts and adds a new dimension. It combines its own connotations with those of the photograph to produce a new image in the mind of the spectator — sometimes an image totally unexpected and unforeseen, which exists in neither words nor photographs but only in their juxtaposition. A fine example occurs in *La Revolution Surrealiste;* the photograph shows three men bending to look down an open manhole and the caption reads: *The Other Room.* Indeed, the Additive Caption may be one of the many rare and fantastic forms those intrepid explorers, the surrealists, domesticated for the rest of us.

"Recent domesticated and photographic examples can be found in the late flood of 'zoo' [and 'caption'] books, wherein snatches of ordinary conversation transform photographs of animals [and more recently works of fine art] into acute burlesques of human behavior, and in Philip Halsman's wildly successful *Frenchman,* where between the printed questions and the photographs of one man's facial expression surprising answers come to mind. The Additive Caption already has performed what seemed the impossible: giving a means of applying the light touch of wit and the penetration of humor to a medium as essentially tragic as what it reflects and which records the unconscious pathos of an attempt to be funny as it records the humor in deep tragedy.

"The first two forms, the Enigmatic Caption and the Caption as Essay, are more literary than visual in their aims and techniques. The Narrative and Additive Captions, however, involve a host of problems in the new language of photo-writing."

12.3.12 Words accompanying a picture may have a considerable influence on the meaning people will get from that picture. In a like manner, pictures used together and viewed in a particular sequence may be given certain meaning beyond their individual content simply because of their location in the sequence of pictures and because of the pictures closely related to them physically. Hicks refers to this phenomenon as "The third effect" and explains that when certain pictures are placed side by side, something happens: their individual effects are combined and enhanced, and a third effect is educed in the reader's mind.

12.4 Projected Visuals

12.41 Projected visuals — motion pictures, slides, filmstrips and other forms — have much appeal and are among the most effective of the visual teaching aids. It is well to remember that they each have important limitations as well as advantages.

12.42 All of the visual materials that require a projector have some qualities in common that are inherent in the fact that they are projected. First of all, projected materials require a strong source of light in a relatively darkened room, and consequently *they attract and hold attention.* Psychologists tell us that it is an almost uncontrollable human characteristic to look at a spot of light in a darkened room. The

projected image, therefore, temporarily unifies the attention of the audience, and there is much evidence that the group will work together better following the projection due to the fact that they have been experiencing the same thing and have more or less similar perceptions of that experience. Another reason for the attention demanded by projected images is the greatly enlarged image that confronts the audience.

12.43 Another advantage of the projected image is its *ability to show great detail.* This is due to the simple fact that material in the projector is enlarged over 50 or 100 diameters on the screen. Thus a picture on a 2 x 2 slide that is actually one inch wide may be enlarged on a five-foot screen as much as 60 diameters and proportionately more on larger screens.

12.44 It must be remembered that even though a slide is magnified 60 times on the screen, this does not mean details are 60 times as clear. It is a common experience to find that approaching a screen closely in order to see a detail better does not help much. As we get nearer the screen the detail, as it gets larger to our vision, also gets fuzzier and more indistinct. It looks out of focus and we are apt to blame the projector or the operator. Actually we have exceeded the combined resolving power of the projector and material together. We will find that we can see the detail better by not getting too close to the screen.

12.45 In the first place, slides, filmstrips, and films are very small in area and the amount of detail possible in them is limited by the physical structure of the image in the film. In the second place, when we get too close to the image on the screen we become conscious of the surface of the screen and this destroys our perception of the depth of the picture. Depth perception is possible only if we are not conscious of the screen surface.

12.46 Just as details help us perceive depth in a picture, so the perception of depth helps us perceive details. This is why it is better not to get too close to the screen. The Society of Motion Picture and Television Engineers recommends that no one sit closer to the screen than twice its width. It is interesting to note that all viewers seem to obey the SMPTE rule automatically in choosing their viewing distance from the television screen.

12.47 Disadvantages to the projected image are largely concerned with the mechanical and administrative details necessary to having the appropriate visual material on the screen at the appropriate time with, of course, the proper audience and with satisfactory viewing conditions. This is not always a simple problem, for it often entails insurmountable difficulties.

12.48 **Slides Versus Filmstrips.** The idea of comparing two such similar media of communication may at first seem like splitting hairs, but actually it is a good way of considering the unique advantages of each device. First of all, there are a number of obvious advantages of individual slides over filmstrips:

1. The sequence or order in which the pictures are to be shown can easily be changed or edited.
2. Satisfactory individual slides are somewhat easier to make than are filmstrips of a similar quality.
3. When slides are properly mounted in glass their surfaces will last almost indefinitely without scratches or other damage.

12.49 There are, of course, a number of advantages that are unique to filmstrips and not characteristic of slides:

1. Obviously, the frames in a filmstrip are in a fixed order and cannot be changed, accidentally or otherwise.
2. Picture per picture, filmstrips generally cost only a small fraction of what its individual pictures would cost if they were purchased as individual slides.
3. Filmstrips require much less storage space and postage, and they are generally nonbreakable.
4. A much wider range of commercially prepared subjects are available as filmstrips rather than as slides.

12.4.10 Of course, with the present state of the art, both slides and filmstrips can be synchronized with a sound recording on a disc or tape in such a way that an inaudible signal on the recording will automatically advance the pictures. Such automatic, sound-actuated devices when properly prepared can often convey almost the same sense of pacing and movement that up until now has been unique to the motion picture. Many times, in fact, over 60 per cent of an audience will believe it has just seen a motion picture when what it has actually seen has been a superior sound filmstrip or sound slide show.

12.4.11 The ease with which a tape recording can be made to accompany such a visual presentation is often a temptation that can seriously detract from one of the great advantages of a slide or film presentation. And this major

advantage is the fact that these devices can be so easily adapted to a given audience for a specific purpose at a certain time *when* they are used with "live" speakers who can "communicate" with their audience, answer questions as they arise during the presentation, and in general gear their words and pictures to the needs and the expectations of a given audience. When a spoken commentary is recorded for such a presentation, much of this sparkle of individualism is destroyed by the resulting "canned" inflexibly-mechanized message — a message that cannot be adjusted to meet changes in audience reaction to it.

12.4.12 One of the major deterrents to the effective use of slides and filmstrips with groups is the fact that group leaders sometimes approach these devices as if they were self-contained learning capsules that need only be flashed before a group of people to achieve their maximum effect. Filmstrips and slides, much more so than well-made sound motion pictures, demand a great deal of active participation from the instructor if they are to be really effective. In fact, these visual devices demand that the instructor play an active role in reacting to them, and in so doing they often bring out the best in an instructor. The ability of an instructor to actively relate himself and his verbal presentation to the visual content of projected visuals is closely related to his knowledge of the visual material. It is, therefore, unwise to use any kind of visual material with a group until you have become fully aware of its content and its teaching potential. Despite this self-evident truth, we often find an instructor using material he has not had an opportunity to study himself before class!

12.4.13 **Motion Pictures.** The motion picture is a most unique medium of visual communication with a language of its own and special techniques that cannot be duplicated in any other medium. (Television may be considered an exception to this; however, it in turn may be considered simply as an electronic extension of the motion picture.) Certainly the most obvious and unique contribution of the motion picture is its ability to reproduce motion as it appears in real life. It also has the capability to slow down motion to almost any degree so that activities occurring with a speed too great for the human eye to see may be observed in "slow motion" on the motion picture screen.

12.4.14 Another unique characteristic of the motion picture is its ability to speed up action. This technique, known as *time lapse* photography, makes it possible to present in a few seconds on the screen action that may have been photographed over a period of hours, days, or even weeks. Much has been learned, for example, about plant growth and development through the use of the time lapse motion picture technique.

12.4.15 Animation, another important and unique contribution of the motion picture to visual communication, is the technique whereby cartoons and other hand-drawn pictures can be made to move on the motion picture screen. Although we most frequently think of animated cartoons, the animation technique is an immensely important device in many instructional films for it can be used to present simplified versions of complicated motion that in some cases could not be seen otherwise by the human eye. The flow of electrons, the flow of blood, the action of the heart, and the action of the internal combustion engine are examples of complex actions that can be drawn simply and presented effectively through the use of animated motion pictures. Of course, this technique has other important advantages in presenting complex social, political, and economic relationships in greatly simplified ways.

12.4.16 A well-made motion picture can be a work of art and a most powerful means of providing a common denominator of experience, changing and creating attitudes, teaching skills, and knowledge, and promoting understanding.

12.4.17 "Selecting" motion pictures, filmstrips, slides, and other commercially produced audio-visual instructional materials is a continuing activity that can perhaps best be viewed as three important steps in the teaching process.

12.4.18 First of all, once the teaching objectives have been clearly established it is necessary to identify materials that can be used to accomplish these objectives most effectively. Keeping informed of existing motion pictures plus new releases is in itself a considerable job. There are, for example, several hundred producers of non-theatrical "instructional" films in this country, and such motion pictures are currently being released at the astonishing rate of several dozen each week. The same is true for filmstrips, recordings, and many other "newer media of instruction."

12.4.19 A number of standard reference works listing and describing such materials are available. In addition, many producers publish helpful catalogs, and educational periodicals often contain specialized listings and reviews of such materials. The Department of Audio-Visual In-

struction of the National Education Association, made up of nearly 5,000 audio-visual specialists, publishes much helpful material in this field.

12.4.20 Secondly, after potentially useful audio-visual materials have been identified but not previewed, it will be necessary to procure them for further consideration and possible class use. When materials are to be purchased, this is a relatively simple matter. However, it is often necessary to obtain motion pictures on some kind of a rental basis, and this procedure often presents the problem of locating a reasonably local source from which a particular film can be rented at the appropriate time. It is important, therefore, to be familiar with film rental sources in your locality. *A Directory of 3,660 16mm Film Libraries*[1] will be a useful resource for this purpose. Film rental libraries often publish descriptive catalogs.

12.4.21 The third and most important step in the selection of such material is the decision *to use* a particular material with students and *how* it will be used. Ideally this decision can only be made after the teacher has had an opportunity to preview all of the existing material on a given subject and to select that which seems to be best suited to the teaching objectives at hand. A considerable body of literature exists on the evaluation of audio-visual materials and on the all-important question of how to use such material most effectively with students.

12.5 Effective Use of Films

12.51 Sixty years ago Thomas Edison expressed his idea that the motion picture projector might well replace the need for teachers and other instructional leaders. As more and more research is done on the most effective ways of using films to teach, it is becoming apparent that just the opposite is true and that the teacher is one of the most important variables in determining how much a class will learn from a film. In other words, utilization (how, why, where, when, and by whom a particular motion picture is used and how it is related to the total learning context) is certainly one of the most significant factors in determining how much will be learned from a given film.

12.52 In their comprehensive summary of 32-years of film research, Hoban and van Ormer point out that instructional techniques applied by an instructor "substantially increase the instructional effectiveness of a film." In summarizing most of the available research on this subject, they point out that anyone using a film with a group should observe the principles of good instruction. From the available research these authors infer that the effective use of films is not so much a matter of applying a "formula" of instructional method to film utilization, as it is a matter of applying the principles of good instruction to methods of film use. There is no "one best way" to use a film any more than there is one best way to work with a group of adults in helping them improve their understanding of a new wheat program. In fact, other studies have pointed out that adopting a rigid outline for using films and following it unvaryingly may decrease the usefulness of films in some learning situations.

12.53 Motion pictures will do little for the weak instructor. In fact they are more apt to magnify his weaknesses than to improve his instruction. Hoban and van Ormer point out that "the influence of a good instructor is an important one in a learning situation. A class which has a good instructor frequently has better morale and is more alert and attentive than a class whose instructor is mediocre or poor. Sometimes this influence carries over into learning situations where the instructor is relatively inactive or is not present at all.

12.54 "Even in cases where teachers use the same instructional materials, there is a variation in the quality of teaching. These differences reflect the teacher's concept of the learning process and his (or her) understanding of the pupils and ability to work with them. Routine instructional techniques probably more often characterize the mediocre teacher than the excellent teacher."

12.55 **Film Instructional Techniques.** "Instructional motion pictures have been produced and used as if the traditional instructional techniques either did not apply to the motion picture as an instructional medium or were nothing more than the eccentricities of 'old maid' teachers. But these techniques do apply, and the following is a list of the instructional techniques, which, *if properly used,* significantly increase learning from films:

"1. Orienting an audience on what it is going to see or summarizing what it has seen.

"2. Announcing that a check-up or test on learning will be given after the film.

[1] *A Directory of 3,660 16mm Film Libraries.* U. S. Office of Education, 1959; 236 p., $1.00.

"3. Repeating the important points (with variation) *within* the film. Showing the film more than once.

"4. Conducting audience-participation (or practice) exercises during or after a film showing.

"5. Informing the learner of how much he has learned. Giving test results or correct answers as soon as possible, or during the film if the practice is conducted during the film.

Research indicates that there is a cumulative effect when several of the above listed procedures are combined. The two instructional procedures that have been repeatedly shown to have a critical effect on the amount of learning from a film are: (1) repetition, and (2) participation or practice of the relevant behavior, either during a film showing or following it. Discussion after a film and taking a test on the film material are both forms of practice or participation."

12.56 **Instructional Leadership.** The leadership qualities of the instructor affect the efficiency with which his class will learn from the film or filmstrip.

"The instructor is a leader of the group under instruction. As a leader, he plans, arranges, and manages instructional situations, materials, and procedures in a way that creates a favorable atmosphere for learning and stimulates the performance of the group. Instructors vary in their ability to create this atmosphere.

"One of the most significant findings of film research is that the amount of learning from an instructional film depends not only on the film and on the audience, but also on the morale and motivation that result from the leadership qualities of the instructor. In one study this motivation and morale appeared to carry over to film learning when the instructor was actually not present during two or three separate showings of the films.

"There is general agreement on the fact that films do not and cannot substitute completely for the good instructor, especially in the exercise of leadership functions, and that a well-trained instructor is one of the essential elements of effective film instruction. There is no evidence, according to Hoban and others, that the instructional methods or procedures used with films are any different from the instructional methods used with other instructional materials."

13. General Principles of Evaluation

prepared by Nathan Maccoby

13.1 Purposes of Evaluation

13.11 Previous discussions have pointed out the specific outcomes sought in a visual communication program. What are we trying to accomplish? What skills, attitudes, and behavior changes do we expect to be present after our training program is over?

13.12 The general purpose of evaluation is to determine to what extent these objectives have actually been achieved. In other words, how successful have we been in bringing about the changes that we sought in setting up and carrying through our communication program?

13.13 There are direct and immediate effects on live audiences—the people who are actually present during a visual communication training course. However, in addition to achieving effects on these, presumably we are interested in achieving or effecting changes in the ultimate consumer—in the farmer, the homemaker, whoever might be the person who is actually using specific agricultural communications. We want changes in the sense of doing something differently than he did before, or having a general way of looking at things that's different than what he did before, or knowing something that he didn't know before.

13.2 Methods of Evaluation

13.21 There are some formal and informal ways of going about this process of evaluation. Basically, the evaluation is a measurement process. That is, the way in which evaluation takes place includes some form of measurement or a series of measurements. These enable the measurer to tell just what effects his programs have had. These range from very crude and informal tools to relatively precise formal ones.

13.22 For example, at the simplest level of evaluation, one simply can observe an audience and see whether it seems to be paying attention or whether it's wandering off and going to sleep. At the most formal level, one can apply a complex experimental design in which before and after measures are taken, measures that have been carefully standardized in advance and in which statistical techniques can be applied to the analyses of the results to determine the extent to which changes are real.

13.23 This treatment of evaluation attempts to give some rather general principles of how evaluation takes place, to give some simple techniques and measures. This will take us into some discussion, of a very elementary sort, of sampling methods, of testing methods, of questionnaire construction and data analysis. But we will keep it simple. We will also discuss ways of getting evaluation as one goes along, namely, the built-in methods. And then, finally, we will examine some way of getting feedback from an audience, what May and Lumsdaine in their excellent book entitled *Learning from Films*, have called "road-testing."

13.3 Sampling

13.31 The reason for talking just a little bit about sampling is that sampling can save much time and effort. When one samples, he measures only some people, not all the people involved, or some of the items, rather than all of the items involved, no matter what the unit being measured. Thus, instead of having to evaluate all of the contents of every program on every person, the application of sampling ideas and principles allows us to limit such measures only to a fraction of the people or material.

13.22 The simplest notion about sampling would be this: for example, say you're trying to find out whether the canned cherries coming off the assembly line in a packing plant are okay or not. It is not necessary to open every single can and test the cherries. In fact, someone might

point out that every time we do open a can we have ruined it. It would be rather silly if we had to open up very single can. We can, however, take every nth can, say every 50th or every 100th or every 200th, or whatever is required. This would tell us whether or not the cans of cherries are being sealed properly and arriving at the point of packing into cartons in good shape.

12.33 Now, one of the first questions that always arises it, "How many should I take in order to be sure?" Whether we take one out of 50 or one out of 200 or one out of 1000, depends substantially on how many bad ones we're likely to find.

13.34 If practically none of them is bad, we don't need to take very many. But if bad ones appear fairly often, or if there's a wide variety in the end product, we must sample a fair number if we want to talk about the proportion of all of them that are of a certain kind.

13.35 It also depends, obviously, on how sure we want to be—what the consequences will be if a bad one gets out. If we want to be awfully sure of this, we must sample at a high rate. If we're willing to tolerate certain amounts of spoilage, then we can sample at a much lower rate. Another question that arises in sampling is, "Well, now, how dependable is my sample; how accurate is it? Suppose I've only taken a sample of one out of every 500 cans and I want to talk about 10,000 cans. How accurately can I do it, how dependably can I talk about 10,000 cans when I've only taken one out of every 500, or 20 cans, to go by?"

13.36 We can answer this one in terms of what would have happened if we'd taken all 10,000. We can't give a precise answer, but we can come within a sufficiently close margin so that for most practical purposes, we are satisfied that we know what we're doing, that the margin of error we're dealing with is reasonably dependable. Just how dependable is something we can discuss as well.

13.37 One of the first considerations that one must take in sampling is the necessity of getting a sample that truly stands for, that truly represents the universe from which the sample is being drawn.

13.38 By universe, I don't necessarily mean people: we can have universes of anything—apples, suits, grass seeds, poultry, or of ideas, test questions, tapes, or what have you. Universes in this sense are not necessarily the universe of all the planets and stars and so on. Instead, our term "universe" simply stands for 100 percent of whatever we're talking about. So if we're talking about the population of the United States of America, the universe becomes all people living within the 50 United States at a given time. Or the universe may be limited to all people who are 21 years of age or over; it could be limited to all those within the city limits of Chicago.

13.39 We have to define the universe before we can sample from it. Failure to do so generally is a common error among people when they first try to do a little evaluation. And, unless you can define precisely the universe that you're talking about, you can't say very much about how to draw the sample.

13.3.10 So the very first thing you've got to do is to clarify for yourself the exact universe of things you want to sample. Is it people? Is it all people who take your course? Is it all people who should take your course? Is it information of a given sort or attitudes of a given sort? What is it? Once you've so defined your universe, it's not too hard to pick a way of sampling.

13.3.11 Another problem in sampling lies in the care made to be sure that the sample represents the universe. Any number of ways exist by which to draw a sample so as to maximize its representativeness.

13.3.12 One of the principal criteria is to see that each member of the universe shall have the same chance of falling into the sample as any other member of that universe. In other words, if you are drawing a sample of adults of the city of Chicago, then any given man or woman 21 years or over residing within the city limits of Chicago should have exactly the same chance of falling into the sample as any other individual in the city of Chicago above the age of 21, no more, no less. There is one technical modification of this that we needn't worry too much about. Provided that the chances are known, they don't have to be exactly equal, and there are some times when this becomes important, such as when we draw a sample from which we want to find out some characteristics of a relatively rare kind of person.

For example, suppose in taking a sample of the adults in Chicago, we were especially interested in the very old people. We wanted to know something about them and what they were doing. If we just let them represent themselves in their proper proportion, we would only get very few of them because our sample isn't a very large

one. But we want especially to talk about the aged so we might end up by deciding to give the very old people twice as much of a chance or more of coming into our sample as everybody else.

13.3.13 There's nothing wrong with that, provided we know exactly what their chances are. In other words, if we've doubled their chances of falling into the sample, when we want to talk about the whole city of Chicago, we simply cut them down. We give each of the old people a half-vote so to speak. If they each have a half-vote, then they're not over-represented when it comes to taking the whole population. And when it comes to studying the old people alone, we've got enough of them so that we can study them as subgroup without having quite as large a sampling error as we might have had had we not doubled-sampled. We can double-sample a sub-group or triple-sample or quadruple-sample just so long as we know what we're doing; just so the chances are clear and we know how to weight them back when we need to. This is perhaps a small point. But it sometimes can be very important. It can be a very practical problem when it comes to small samples and a subgroup with whom we shall work and want to know something about.

13.3.14 Samples that do not guarantee equal selection of every member of the universe *are known* as biased samples. We tend to think of the word "biased" as meaning "prejudiced" or "in favor of" something or other. But actually "biased" is a statistical term. Here we intend it to mean that some members of the universe have more chance of appearing in the sample than others. The method of drawing the sample is "biased" in favor of some people in it rather than others.

13.3.14a The famous *Literary Digest* poll of 1936 had the great misfortune of predicting that Governor Landon would defeat President Roosevelt for reelection. A real problem of the pollsters was that, although they had an extremely large sample, they had an extremely biased one because of the ways they had obtained the sample. They had used only lists of telephone subscribers and in the days of the depression many people couldn't afford telephones. Poor people were more likely to vote for Roosevelt than for Landon, yet, the poor people had a very low chance of being represented whereas well-to-do people had an unusually high chance of being represented in the sample. Thus the sample was biased and led to a poor prediction.

13.4 Avoiding Bias

13.41 It is not hard to draw a biased sample, so one needs to avoid many pitfalls in sample drawing that lead to biases. One simple way to avoid them is to use a random method of selection. For example, if you have a list of people that constitute the population or universe from which you want a sample, then take every nth person off that list in a random way, any way that is random. (Incidentally, here is a way to demonstrate that people can't pick a random number but rather should use some automatic device for doing so: suppose you have 40 or 50 people in a group. Say to them: "Now I want to see if you can pick a random number from one to ten. Take a pencil and write down as quickly as you can, without consulting a neighbor or anyone else, the first number that pops into your head between one and ten." And after they have done this, tell them to be sure not to change the number no matter what happens. Ideally these numbers ought to be collected and tallied centrally.

Hand-show tallies are quicker, but people may change their choices. Use a blackboard or other form of visual presentation to tally hand counts alongside each number from one to ten. If there are 100 people voting, there should be exactly ten of each number, within chance variation. You wouldn't expect it to come out perfectly — you might get 9 or 11, or even 12 or 8 votes for a given number occasionally. But lo and behold, you *find that if scoring* is done honestly, there is quite an unequal popularity of the digits: If people aren't sophisticated about this, you'll find there are far too many threes and sevens, and far too few ones, twos and tens, and there may be a cluster at five.

Sometimes when people are very sophisticated and are trying to avoid threes and sevens, you'll get no votes — or almost no votes — for threes and sevens because they're trying to fool you. But in any case, people really don't give you what you would expect by chance. People don't choose on a chance basis. They have certain guessing habits, and these guessing habits lead them to choose in a very non-chance way. The lesson of this is that you need a more automatic process of arriving at random numbers than the process of just thinking of one or two or three, as the case may be.)

13.42 There are tables of random numbers provided. Many statistics books have them. There are also simple ways of making your own. For example, you want to take every 10th name off a list, and you don't know whether to start with the first name or the ninth name or the

tenth name, or the eighth or the fifth name or the third name. You do want to give everybody exactly the same chance though. Solve this problem by taking ten little slips of paper and write a digit on each. Fold these up and shake them up in a hat. Have someone pick one of the pieces of paper out of the container without looking and start with whatever number is picked.

13.43 That is the classic method—drawing it out of a hat — and it will give every single number an even chance of showing up. If the number turned out to be two, then you'd start out with number two, and you'd pick the second, the twelfth, the twenty-second, and the thirty-second, and the forty-second name on the list until the list was completed.

13.44 That particular method is actually a so-called "stratified random method," called that because the list is arranged in a certain order in advance, before one picks out — makes a choice from it. You want to preserve that order, sometimes at least.

13.45 Suppose you want to get exactly the right representation of men and women and there are, say, a hundred people to choose from. You want a sample of one in ten. That should give you five men and five women, if there are exactly fifty women and fifty men in your universe. But just by chance alone sometimes you might end up with as many as seven women and three men or vice versa. You want to avoid this if you can. One way to guarantee that you do get exactly the right proportion and still use random methods is simply to divide the universe into two subuniverses, the fifty men and the fifty women. Sample at the same rate from each — take one out of ten on a random basis of the women, do the same to the list of men. Then you'll get exactly five men and exactly five women, and you still have a random sample of ten people.

13.46 You also can do this on more than one thing at once — for instance, if you want to be sure that you get the right representation of men and women and the right representation of young and old people. You could divide the group into halves — you might want to divide it into three, four, or five subgroups, but let's say you just divide it into two — the upper half of the age group and the lower half of the age group. Now you've got four sub-universes. You've got old men and young men and old women and young women.

13.47 The virtues of this device are evident. With the four sub-groups of old men, young men, old women, and young women, all exactly represented in their right proportion in the sample, there are just exactly the right number of them in the sample as compared to their position in the total group or universe. At the same time you've preserved the principles of an equal chance for everyone in the total group or universe to appear in the sample.

13.5 Clustering

13.51 Similarly in sampling, another device used for purposes of convenience and money-saving is that called "clustering." Instead of drawing individuals, it is possible to draw groups or clusters of individuals. This avoids an enormous amount of travel in case people drawn completely at random from the list are spread out over a lot of country. In other words, individuals can be arranged by geographic locale, and one can divide a city into sections and take every nth household within every nth block.

13.52 Here is an example. Suppose that from a city of 100,000 families one was going to take a sample of 1000. This means a sample of one family out of every 100. Every family in this city should have exactly one chance in 100 of falling into the sample. Now if we were to take the city directory and to take a random number between 1 and 100 and then take every 100th family essentially we would have a random sample of families in the city. But this might result in our having to travel to every nook and cranny of the city. Suppose instead of that — for purposes of convenience and cost-saving — we were to divide the city into sections. We could, as a matter of fact, combine stratification and clustering by organizing the city by socio-economic districts. Usually cities are organized by the best neighborhoods, the not-quite-so elegant, and so on down to the poorest ones.

13.53 Within each of these neighborhoods we can apply our over-all sampling rate if we like, but we can now arrange the neighborhood by blocks and take every nth block. Suppose that we take every tenth block. We can start with a random number between one and ten, with that as the first block, and we would take every tenth block from then on. This would give us a sample of one in ten for blocks. If we took every tenth household on a random basis within each of those selected blocks — within the ten percent of the blocks we've now got in our hands — we would have one out of every 100 households, or every tenth household in every tenth block. This would give us an over-all rate of 1/10 x 1/10 or 1/100 —

the sampling rate we wanted. We've also preserved our sampling requirement of giving everybody the same chance. Instead of going to every block, or practically every block, in the district we now are going only to every tenth block. And we can repeat this process throughout every district in town.

13.54 This is a perfectly legitimate procedure. In so doing, however, we've probably run up the sampling error a bit. For instance, if it should turn out that all of a certain type of people were on two blocks and if we happened to strike one of those two blocks we would be over representing that particular group of people.

13.55 Let's say all the immigrants from Mars live in that two block area, and they're a peculiar bunch of people. We want to make sure that they're represented just right, not too much or too little. If we take every tenth block and happen to pick one of those two blocks that are full of Martians, we're going to get too many Martians in our sample. But, on the other hand, should neither of the two blocks fall into our sample (which is even more likely for actually they have only a small chance), then we're not going to have any Martians at all. They'll be clearly under-represented. No matter what we do, we're going to have trouble with proper representation of Martians and this is going to increase our error.

13.56 Notice that it doesn't increase the bias or introduce bias, because we don't know whether we're going to have too few or too many and therefore the direction of error is unpredictable. And if the direction of the error is not forced by the sampling procedure, then no bias is introduced — there is nothing inherent in the system to guarantee in advance that any particular group is going to be over- or under-represented, only that it will be either under- or over-represented.

13.57 To summarize briefly, the idea of stratifying has to do with arranging populations in order prior to sampling to reduce error. The problem of clustering involves sampling in groups for administrative convenience, even though it tends to increase error.

13.6 Sampling and Error

13.61 Let's go back to a problem we discussed briefly earlier — how we can tell from the sample how far off it might be. Suppose we had taken 100 percent of our universe instead of just a small sample of the sort we've been talking about in our illustrations. How far off might our sample be? What sort of figures would we get from our sample as compared to the figures we could get if we'd taken the whole universe?

13.62 Clearly one can't tell exactly ahead of time what would happen if the whole universe were measured instead of just a sample. He *could* measure the whole and see what would happen. But we're trying to avoid measuring the whole universe when we use a sample. There are some pretty good ways of estimating just what would happen, and it turns out that there are two primary factors that are responsible for variations in the sampling error.

13.63 First of all let's clear up what we mean by "sampling error." It is simply the very thing we've been talking about, namely, how far off a measure might be, based on a sample, as compared to what it would have been if we'd taken the whole population or universe. In other words, how far off is the sample from the total? If we're taking cans of cherries off the assembly line, and we found one out of every 500 was bad on the basis of a sample, what would we have gotten if we had opened every last can — would it still be one in 500 or would it be one in 400 or one in 600 or one in 800 or what? We can't tell exactly, but we can estimate this pretty closely. The sampling error varies with the size of the sample and with how different the members of the population are from one another on a particular measure.

13.64 Here is an illustration. Take the second point first: suppose we didn't know and were trying to find out how many fingers there are on a human hand. Our first problem is to determine how many human beings we would have to have in our sample before we could generalize with some safety to all human beings — the universe of human beings. Maybe there are some known cases of six fingered people and four fingered people, but they are very, very rare indeed, and the chances are that if we do a sample of two people at random from the world, we would find that each of them had five-fingered hands. If we drew three, they'd still all have five-fingered hands. No matter whether we drew four, five, six, or how many, we wouldn't need to draw very many before we could tell about the whole population of people. People are alike in the number of fingers they have and you don't need a large sample to predict such a similarity.

13.65 But suppose we chose something in which people are different, for example, how much they weigh, and we are interested in trying to get a picture of how much people weigh. If we took a sample of two or three at random from the

whole population of the world, we might end up getting rather large differences — some people might weigh under 100 pounds, some over 300 pounds, and anywhere in between. We know that there's just a lot of variation in the weight distribution of people. Therefore, given the same size sample as in the case of the number of fingers on the hand, we're going to have a much larger sampling error.

13.66 If we were to take ten people and count the number of fingers, we would find that we had almost no variation at all — our spread would be zero. But in the case of weights, we probably would find that we had considerable variation from person to person. Therefore predicting everybody's weight is far more hazardous from just a small sample. You can see that as the variation becomes greater, the hazard increases.

13.67 Another way of putting it is to say that as the characteristic being measured varies from member to member in the population, the sampling error for a given sample increases. And, conversely, as the variation reduces, or gets smaller from person to person, from member to member in a sample, then the sampling error, given the same size sample, will be smaller.

13.68 Now let's go back to the first cause of sampling error — that the sampling error varied with the number. It's pretty clear that the larger the sample one draws, the smaller the error is going to be in predicting the total universe from the sample. It perhaps is not so clear to say that the proportion of the universe that this number represents turns out to be not particularly important, but rather the absolute number itself.

13.69 Let's take the weight distribution again as an example. If we take just one person, he's liable to have just any old weight, and there's just no telling how far off we might be. Suppose we are after the average weight. Then if we took two persons and added their weights and divided by two, we'd get an estimate of the average weight. Obviously this could be 'way off; in other words, we might happen to get two, 300-pounders, and we'd come up with an average of 300 pounds whereas obviously that's much too large. On the other hand, we might get two, 100-pounders, and we'd come up with an average of 100 pounds. That's obviously too light.

13.6.10 But if we increased to three people at random, the odds are that we're going to move in toward the middle — that is, the odds are that we're not going to be either 300 or 100 any more, but the odds are better that we're going to be more toward the middle.

13.6.11 Take four people or five people or six or seven or eight or ten people. By the time we take ten people drawn at random from all the people in the world, the odds are pretty good that the average we get from adding the weights of these ten people and dividing by ten is going to be somewhere in the middle. It's going to be much closer to the true average for the whole world than when we draw just one or two or three.

13.6.12 The point is, does it matter whether the population of the world is two billion or three billion or four billion? Suppose we took a random sample of 100,000 people drawn at random from all the people in the world, with everyone in the world having exactly an equal chance of appearing in our sample. Suppose we took these 100,000 weights and took their average. We would be awfully close to the true average — that is, the average of all the people in the world — if we had an opportunity to measure it. And it wouldn't make much difference really whether there were one billion or two billion or three billion, or ten billion people in the world. The fact that we drew a sample of 100,000 would guarantee that our average based on that would be dependable and would predict closely the average of the total, just so our sampling procedures were valid.

13.6.13 There is an exception to this, and that is when we get mighty close to the total. In other words, if we're taking something like half of the total population, or 1/3 of the total population, then the fact that we're dealing with a proportion of the total enters into the picture. But for most practical purposes, you wouldn't be sampling if we were drawing a half or a third of the total population. We might as well use them all.

13.6.14 Normally we're drawing rather small segments of a population, and we're worrying about our sampling error. Actually, if we can get enough of them our sampling error isn't going to be too bad. It depends, of course, on how variable the scores are from one to another — our point two. If we get scores that don't vary too much from one another and if we can get a decent number of cases we're all right.

13.7 Size of Sample

13.71 People are always asking, "Well, how many do you need to have before you can have a sample that is okay?" The answer always

has to be, "Well, how accurately do you need to know it, and how much time, effort, and money are you willing to spend to know it that accurately?" That's because as the number of cases increases, the sampling error drops. Usually we might be able to say that the average height, for an example, of all men in the world is 68 inches, plus or minus so many inches. It's the "so many" that varies with the size of the sample.

13.72 In other words we might be able to say that it's 68 inches, plus or minus a half an inch. Fine, if that's as close as you need to know it — that is fine, if you know that the odds are pretty heavy that the true average would be somewhere between 67½ inches and 68½ inches for everybody in the whole world. There's no point in spending any more time and effort and money in finding it out any more accurately. But if it's a matter of great consequence to you to be right within the nearest quarter of the inch, then, of course, the sampling size will have to be increased enormously.

13.73 As a general rule it turns out that you have to multiply your sample size by four in order to reduce the sampling error by one-half, other things being equal. We won't go into the techniques for computing sampling error here for these can be determined from texts in statistics, some of which are mentioned in the bibliography. The main point to remember here is that as you increase the number of cases you reduce sampling error. And as you have more variability from person to person on the trait being measured, the greater the sampling error. Also, as the variability reduces, the lower the sampling error.

13.8 Testing

13.81 Now let's talk about testing. Much of what one attempts to communicate has to do with information, communicating information, skills, and sometimes attitudes. Basically one wants a test which would give an answer to how much is learned from either a particular message or a whole group or set of messages. One needs a method to determine how changed — how different — people are as a result of being exposed to this program of communication. This goes right back to the question of the objectives because the differences that one hopes to get are the differences in the total objectives.

13.82 One should avoid devising tests simply for the contents of the messages themselves and instead should always go back to the objectives in arriving at tests. It's the objectives that you're trying to get across, not the content of the message, and omissions in the content also should not occur in the testing.

13.83 Certain information needs to be communicated. If a list is made of these things, then test questions usually can be devised, often in the form of verbal test questions. Sometimes they are non-verbal or straight visual; sometimes they're behavioral or performance tests. For example, if you're trying to teach a man how to assemble something or how to fertilize a field, verbal questions may not suffice. You want to watch him do it and see how he can actually do it, see whether he can do it — for real and not just on paper. Basically a test should cover the content of the objectives appropriately.

13.84 The question arises, should a test, if it is on paper and pencil, be the so-called objective or closed-ended type test in which you check an answer, or should it be open-ended in which people are asked to write out in fairly free style what the answer is. The answer to that depends. Generally speaking you want your test to be reliable so that no matter who scores it or how it's scored the same answer comes out each time. You want it to be valid — to measure what it is you hope it will measure, what it's supposed to measure.

13.85 If you're trying to find out how well a man understands some principles of say, fertilizing ground, then perhaps a series of verbal questions can do this. Some people, who may not read well or have good vocabularies, can still understand the principles of fertilization very well indeed; asking for this in terms of words can be misleading. However, assuming that we have people who can read and write respectably, you can ask some of these things in words.

13.86 Closed-ended items—for example, true-false questions, a listed series of answers, of which one is supposed to be right for each item, or items calling for a matching of certain things on the left hand side with certain things on the right hand side of the test — tend to give fairly reliable or dependable answers. It doesn't make much difference who rates the paper or who the teacher is, the score on the test is going to be the same. A certain answer will be right or wrong, no matter who scores it, provided the scoring key is agreed upon in advance.

13.87 On the other hand, open-ended questions present more of a problem. You may have two experts read the answers. One of them says "This is a wonderful answer." The other one may say, "This answer isn't very good."

13.88 So this is the problem. It's possible to achieve reliability when you have open-ended material, but it takes some doing. Usually, to get reliability the points have to be listed that need agreement. Say, "We'll give so much credit for mention of such and such a point and take so much off for this and that kind of error." Then you need to try out your agreement: have the same answers read and rated independently by the two or more people who are going to do the rating, then compare the answers and note differences. Start all over again, until you get a satisfactory level of agreement. Check this revised version on *new* material and see that you are getting a satisfactory level of agreement between scores.

13.89 It's not necessary, incidentally, as some people feel, for objective tests always to be about straightforward facts and routine uninteresting things. Actually it's possible to test complex ideas in this way; it just takes a little ingenuity in writing the questions.

13.8.10 We have talked about behavioral tests of skills. You can actually watch people perform something but again you must worry about reliability. The question remains whether two people equally competent watching someone perform would come up with the same judgment of performance. This again should be tried out in advance on a trial basis, because of possible hazards. Just because it's a matter of actual behavior doesn't mean that the measure of it is going to be reliable. The same principles have to be followed as for open-ended verbal tests.

13.9 Testing Attitude Change

13.91 In addition to changes in information that have to be tested for and changes in skills that have to be tested for, perhaps the most subtle and most important of all are changes in attitudes. They need to be tested for too. Probably the most important function of an agricultural communication program is to shift or change certain attitudes. Maybe what you want is a different attitude toward the use of experts and you have to find out whether there's any change on this.

13.92 The most important thing is to get the initial level of attitude just as it is in the case of information. In other words, if you're trying to test for changes in information, you've got to find out what the initial information is. If everyone knew it all before you started, you didn't teach much. So you've got to find out what people did know when you started so that you can find out just how much they've learned. The same thing is true with respect to attitudes. In fact, almost exactly the same principles apply to measuring changes in attitudes as those applying to measures of changes in information and in skills.

13.93 Basically you want a valid and reliable measure of attitudes before any change is supposed to take place — before any program of communication is instituted. It's necessary to take a measure afterward, and there are lots of problems about taking some of these measures. Perhaps the best summary — the best source of material for how to measure attitude change — is in a volume called *Experiments in Mass Communications* by Hovland, Lumsdaine, and Sheffield, published by the Princeton University Press in 1949. This reports a series of experiments in which films — attitude or orientation films — were presented to soldiers in World War II. Effects of these presentations were measured under carefully controlled conditions. In addition a number of other kinds of communication programs designed to effect changes in information and skills, in some cases, and attitudes in other cases, were measured; effects of these were measured rather sensitively and precisely.

13.94 The important thing is to find out just what you are accomplishing in your program. This can be done by some form of automatic testing, instead of relying just on impressions. If one is trying to teach skills, then test for those skills at the end of a session — at the end of a program of training — and compare them with the skill level at the beginning of training. If it's a question of information you can test that with a paper and pencil test; again, compare post-training test scores with pre-training test scores to see if significant differences have taken place.

13.95 You'll need to be concerned about a number of things. For instance people may learn a good deal but not because of your program. Instead they picked up the information somewhere else during the same period of time. Therefore have a control group of people who are not exposed to the program. And, if you test these people at the two different points of time, any changes which they have could not be caused by the training program. The differences between the changes in the control group and the changes in the experimental group — those who received the training — should be attributed to the training program, and not the differences that would otherwise have taken place.

13.96 The same principles apply to attitude changes. The changes in attitudes that are supposedly the result of a training program

ought to be tested by administering some form of questionnaire before the training program and a similar form at the end. If possible, this also should be compared with scales administered at the same time to people who did not take the training program. Such people should be similar by having attitudes presumably the same initially as the trainees whose attitudes are not the same when the program ends.

13.10 Road Testing

13.10.1 Of importance here is to attempt to get some systematic, reliable, and valid measure of change. We have discussed some rather formal methods. There are, as indicated above, some built-in methods in addition. Lumsdaine and May talk about "road-testing." Let's talk of two of a number of such techniques that are less formal, less systematic, and less precise perhaps than some of those techniques and measures we've already discussed.

13.10.2 One of these devices is simply to use experts to take a look at the program and give their judgments. This can be elaborated, but basically that's all there is to it.

13.10.3 Another way is to pay attention to, observe, and talk to people as they attend a program. This is probably the more usual way in which people test their teaching effectiveness, or determine the success or failure of a communication session. They just watch to see how people seem to be reacting: Do they look interested? Do they look bored? A series of studies have shown that people who are most interested in watching a film will tend to be absolutely motionless, whereas people who are bored by the film tend to get fidgety, move around, and finally fall asleep.

13.10.4 We don't know whether movie-attention characteristics would hold up for other forms of presentations to an audience, but it's not a bad sign. After all, if people are really interested, they are going to pay attention. Their eyes will be glued to the speaker or the visual demonstration, or what have you. If they're bored, they'll be doing all sorts of other things. They'll be easily distracted; they'll pay attention to lots of extraneous stimuli but pay little attention to the focus of the communication. That is one way of measuring audience interest.

13.10.5 Another measure, of course, is to simply discuss the subject of the program with them afterward. Have them tell you what they thought about it, whether they thought it was worthwhile. Did they like it or didn't they like it; did they find it interesting or were they bored? Many things come out just in ordinary, informal conversation. They will not be quite as objective, as reliable, and as valid perhaps as the more formal methods, but they will help you evaluate what has been going on. They certainly could be used to supplement other methods.

13.10.6 Finally, perhaps the most important measure of the effectiveness of any program of education and information will reflect itself in the actual, subsequent, long-term behavior of receivers. In other words, if a program is designed to add information and change attitudes and behavior about child-rearing, the acid test is "How do these people behave with their children after receiving my program? How does their behavior now compare to their behavior had they not had the program?"

13.10.7 If the objective of a program is to get people to operate their farms in a somewhat different way than they have been doing, then the acid test is "Do they actually change in the direction that is advocated by the program? Is their change immediate, six months later, a year later, five years later?" This is the real proof.

13.10.8 Some of the questions suggested here are not too easy to answer. Perhaps systematic field observations could be undertaken which would make clear in the long run just what effects — long term, real, and lasting — have taken place. But again, there are some dangers. Sometimes the people who are most likely to pay attention to innovation, to what is current and choice in the way of improvements, are the very people who come to your programs. If we just look at those and compare them with the people who did not come, we might find that more change takes place among the people who did come.

13.10.9 It might well be that those people would have changed anyway. They definitely are not exactly like those who didn't come. People who don't come are much more likely to be people who wouldn't change if they did come. This is a caution to keep in mind. The only way to deal with it is to assign people to your programs at random. In other words, keep half of them out. Of course, this isn't feasible and you're not likely to do that in any case. Thus you may have to resort to observation. At least observe the changes that do take place. They may be changes that could easily have resulted from things that took place in your programs. Whether your programs can take credit completely or not, we may never find out.

14. Administration: Visual Communication Programs

prepared by Hal R. Taylor

14.1 Introduction

14.11 Visuals are means to ends rather than ends in themselves. Whether one conducts a visual program for himself or for others, such an attitude becomes essential in placing visual communication in a useful role with regard to the broad objectives of an institution or organization.

14.12 There is no one best tool in the visual communicator's kit. Each method has its own particular strengths and its limitations. Each works well under certain conditions and in certain situations. Effectiveness generally depends upon how skillfully the teaching-learning situation is handled by the instructor and how a particular visual device is used in the total teaching context.

14.13 One visual medium normally is best used in combination with other visual media or other means of communication, since the more we can make use of multiple channels the better likely we are to succeed in transmitting our message. Just as the writer varies size and organization of words and paragraphs as he writes a descriptive story, so does the most effective visual communicator combine a variety of tools for best results. At one time, he may wish to supplement a visual medium with verbal communication and discussion techniques. Later, he may find that the same, or similar, visual medium performs more efficiently as illustrative matter in a written communication.

14.2 Coordinating Visuals in a Total Communication Effort

14.21 As use of visual means of communication spreads throughout an organization, it becomes necessary to incorporate and use visuals as integral parts of the program in which we are involved. No longer are visuals novel. Today audiences quickly learn to expect visuals to perform a service — that of aiding faster understanding and a deeper knowledge about almost any subject. If visuals are to do this, even when they also serve as attention-getters, their impact should not overpower the subject-matter message they carry or intend to communicate.

14.22 Anyone responsible for the planning and development of a broad educational program — whether in a county, state, or federal organization — must recognize and be sensitive to audience expectations. People want answers to specific questions. But frequently they also want answers integrated with their broad interests and plans. Too frequently they themselves must interpret or integrate information from different areas of subject matter. Consequently, if answers are incomplete, people are forced into excessive, undirected effort as they attempt to assimilate information into the context of their personal interests.

14.23 Similarly, excessive use of one medium or even reliance upon many different media sometimes fails to provide the response desired. Quantity of information presented is never a direct measure of effective communication.

14.24 Four principles for integrating visual communication efforts with other communication techniques are useful:

1. Correlate visual communication efforts with other teaching materials.
2. Use visuals to *support* the particular topic being taught.
3. Test visuals to determine response and effectiveness in supporting the basic problem or program area.
4. Relate visual and verbal messages to some common experience so that they will reinforce each other — in other words, be sure to communicate effectively.

14.25 Visual communication has much in common with other means of communication. Effective communication is an essential ingredient of teaching. Perhaps teaching transcends

the much more simple act of mere communication, since teaching must also include a good understanding in depth of things, i.e., what is to be taught to the learner; planning, presenting, and organizing experiences; and evaluation of the message taught. Even when we say that good teachers supply motivation and even inspiration — we are also touching on concepts similar to the persuasive acts of communication.

14.26 To communicate effectively, the teacher must know his students — how they learn best, their individual skills, knowledges, abilities, and their fears and desires. As we use visual means to communicate, we complement learning — we blend cues of previous experiences into meaningful messages, thereby promoting understanding, developing it, and enhancing thinking.

14.27 Unfortunately, many who must administer a program of any kind have considered visual techniques and materials merely as supplementary "aids" rather than integral and indispensable communication elements in an educational program. No one has been entirely at fault for such thinking. Little substantial research exists to tell how best to administer a visual communication program. A few studies do indicate that the most important factor for success is the personal leadership of the program director, but no research points out specific administration procedures for him to follow.

14.28 Often then, visual operations merely grow, like Topsy, into centers for the storage of equipment. They become production shops without creativity. Then it becomes even more difficult for administrators to determine how to establish and operate a visual program at its fullest capacity for the organization's broad responsibilities. But at least a few operational goals may help alleviate confusion and misunderstandings. They include developing and using to the utmost existing resources and materials; organizing and operating more economical and efficient methods for the handling and use of equipment and materials; and furthering the knowledge and skills in visual communication of each staff member through simple, yet extensive and thorough, training programs.

14.3 Making Maximum Use of Existing Materials or Resources

14.31 Individuals who must develop a program in the use of visual communication can rely on two key points useful as guideposts to progress. First, many effective visual materials do not always require a large budget and often can be constructed or improvised from materials already available. Second, the artistic skill or talent of the person who plans to use visuals is much less important than his common sense, alertness to new possibilities, and sincere interest in helping others learn.

14.32 Few county extension offices or other field offices are so remote as to have no available resources for preparation of simple visuals. Perhaps there are few offices without a visual program of one kind or another. The question then lies in the degree of organization: the degree of planned, intensive, and successful use of materials already available. Therefore, even an office with already established plans, containing excellent equipment and staff, might wish to reexamine its efforts for possible changes.

14.33 One method of going about this would be, first, to analyze the needs. Included would be a survey of the subject-matter program area to determine what equipment and materials are already on hand, the extent of their use, and the possible restrictions on their use. Once known, services may be improved through an organized, systematic plan for operating — as formal or as informal as needs may suggest.

14.34 Provisions for services presuppose that the functions of the program call for services. Whether such needs are immediately evident or not, there should be a continuous study of the program to keep personnel informed and up-to-date on program policies and changes and any technical and specialized assistance available from others. If possible, the study should include a plan of detailed action research about short-term and long-term needs, based on the original survey of visual equipment and materials.

14.35 Thus it becomes possible to balance materials in terms of adequate coverage of the subject-matter program and in terms of the different types of visual materials on hand. It also is possible to plan a budget and time schedule for obtaining new materials that are unavailable from resources within or outside the organization. Most important, an organized study can include provisions for production of effective, yet inexpensive materials.

14.36 Problems of budget, of course, may create from the outset a serious limitation on how broad a visual program shall be. If plans include obtaining various pieces of projection equipment, probably it would be best to gain support from the central administration funds, at least in part. Then, rentals can work as a library

without a charge for each service or loan. Production services requiring minimum materials and supplies might be chargeable and payable to a revolving fund from which payments for replacements of supplies and materials could be made.

14.37 County offices, whether or not they are serviced by a state visual specialist, often cooperate with adjoining offices on equipment and various specialized services. Even if funds for materials are plentiful, such a practice can help avoid duplication of materials and equipment and create more efficient use of expensive items.

14.38 But no matter the size, budget, or staff of a visual operation — whether that of a centralized state office or a county office — the major purpose should be that of improving instruction. Each office can improve its instruction and self-services. Here are five ways:

1. Collect and distribute information to staff members about availability and use of materials.
2. Stimulate and sponsor production of homemade materials.
3. Develop a collection of teaching materials for distribution to staff members and cooperating individuals or groups.
4. Encourage practical research in visual communication use for improvement of the instructional program.
5. Design and promote an organization-wide program for use of visual teaching materials.

14.39 The five points above were formulated more than 20 years ago as objectives for a school system in Cook County, Illinois. They still offer a substantial beginning point, or reorganization point, for any center today.

14.3.10 Innumerable resources exist which discuss making and using visual materials. The bibliography lists several books useful as guides to visual production and administration.

14.3.11 Items listed in the bibliography are written primarily for the teacher who uses visuals in classroom teaching. Each item has ideas adaptable to extension work. Dale, and Wittich and Schuller list possible sources of materials of special value to county workers. Of particular interest, probably, in administering a state visual program are points suggested by Francis W. Noel in the 48th Yearbook of the National Society for the Study of Education. He offers a number of functions of a visual unit applicable to extension programs. Included are these, especially useful to a state-wide organization or large county or field office:

14.3.12 **1. Providing materials and professional services so instructors can use visual materials under the best possible conditions.** For example, suggest the best means of darkening rooms or controlling light, ventilating rooms, placing electrical outlets, and improving accoustics; give guidance and counsel on proper room conditioning when new construction is being planned; obtain sufficient copies of various materials to meet additional requests that arise from use; urge procurement of enough portable equipment to meet demands; service equipment and provide standby equipment for use when other equipment is being repaired; train others in the operation and care of equipment and in proper handling of materials.

14.3.13 **2. Providing those services which make it possible for instructors to have materials and equipment when they need them.** For instance, issue catalogs, bibliographies, and special bulletins giving accurate, up-to-date information on available materials; work out a filing system so that materials will be readily accessible; establish a distribution system to make it easy to obtain materials, considering convenience of most importance to the person who will use them rather than convenience to the supplying sources; see that equipment is kept as close to the point of use as possible — if necessary, assign equipment to individuals on a long-term basis to avoid costs of maintenance and transportation damages; see that equipment is regularly inspected and serviced — through a minor maintenance operation, at least, such as oiling, replacing lamps, etc.

14.3.14 **3. Providing materials and services which allow specialists or agents to select and use materials which fit their teaching-learning situations.** For example, cooperate with supervisors and other workers in selecting materials; buy materials on the basis of program needs; assist supervisors, agents, and specialists in choice and use of material; plan production of and produce simple materials to meet specific needs, but *limit production to those materials not available from commercial sources.*

14.3.15 **4. Providing facilities and professional services which assure that materials will be used as an integral part of the total extension program.** For example, when possible buy materials that meet the needs of all age groups contained in the program; cooperate with other organizations on continuous program revision plans; continually evaluate materials in terms of program objectives, and, if possible, experiment and conduct research which may contribute to

revision; supervise use of materials at all levels, by working directly with co-workers, by working indirectly through in-service training activities, and by keeping supervisors and administrators informed of progress.

14.3.16 **5. Providing those services which will help instructors make full use of local resources already available.** Possibilities would be to assist in locating materials, places of local interest, professional designers and other people who can contribute information and experience to particular operations; work with instructors to survey and appraise local resources preliminary to the development of a list of suitable resources. Too often we forget local, state and national A-V groups with whom affiliation would be worthwhile.

14.3.17 **6. Providing those services that will assure instructor competency in use of visuals as well as supervisor-administrator competency.** For instance, be concerned with a continuous program of in-service growth to help personnel gain knowledge and understanding, skills and abilities essential to effective visual use. Included would be the philosophical and psychological factors underlying use of visuals; results of research studies; types of visuals available in specific areas; local or nationally available sources of materials and equipment; values and limitations of visuals, methods of obtaining, storing, filing and maintaining kinds of materials and equipment; principles of good teaching that affect selection and use; processes involved in the production of simpler materials; and the service procedures and policies available within the organization and the responsibilities of others necessary for best services to all.

14.3.18 In other words, the person or persons administering a visual program must provide professional leadership to help create competency in the use of materials. Many states already do this, in part, by preparing teacher's guides and manuals, lists of resources and suggestions for use, urging appointment of preview and selection committees, and in planning or conducting meetings and workshops or through individual conferences.

14.3.19 Such activities soon develop the necessity to provide material and services which will help administrators interpret the total extension program to professional and lay groups. Noel suggests two ways to help: (1) produce visual materials which help explain the organization's program to its own personnel and to the public; (2) provide equipment and materials to outside groups when their use is related to the organization's program and might help in the formulation of regulations or interpretations of it.

14.4 Problems of Storing, Filing, and Adapting Materials

14.41 One of the most frustrating tasks of any educational office is that of keeping up with visual materials. Even if adequate storage space is available, few offices have a system for finding materials quickly. And even if such a system exists, all too frequently much of the material is stored and forgotten, seldom — if ever — used again, despite the economies of materials which may be useful in a different situation or circumstance than that originally intended.

14.42 Tasks of keeping records, filing poster and chart materials, and performing routine tasks of handling should require a minimum of effort and operate in their simplest form. The degree to which such office procedure is organized depends on the particular needs and upon amount of space available, number of people who will use the materials, whether the office receives or distributes materials in packets, and individual preferences or office policies.

If an office distributes and loans visual equipment, as in a state visual operation, there should be some method for determining who has what on loan, when it shall be returned, when and who has requested it for loan next, and when each item *was last serviced.* Films and filmstrips *must* be inspected after each booking, and some definite procedure becomes essential for booking these too.

14.43 Simple clerical forms work most satisfactorily. Some state offices keep film and equipment records on cards; others use a large sheet of paper for each item showing a year's record at a glance. Size or form of records would depend upon number of films to be rented and various types of machines owned and loaned by the office.

A constant re-examination of routine operations helps to see which steps might be eliminated or improved. After all, the main purpose should be primarily to serve others. Noel describes one system in which a large visual department fined individuals for overdue materials. A look at the records showed that the department spent a dollar for every 10 cents it collected. Elimination of the

fines, plus a program of urging users to return equipment and materials on time, solved the problem and reduced record-keeping to a minimum.

14.44 Storage of materials—flannelboards, chalkboards, charts, posters, exhibit panels, models, etc. — obviously requires special treatment if the materials aren't to become dog-eared and worn. More important, there is little point in keeping chart and poster materials at all if there is no intention of ever using them again.

14.45 Some offices keep flannelboard symbols, posters, charts, etc., on edge in storage bins separated by vertical dividers, much like music houses store records. Each bin or section within bins is labeled according to content. Access to materials then becomes much more convenient than if items are stacked on top of each other. Such an arrangement also facilitates storage of unused poster board and similar supplies. It may be possible to store flannelboards, chalkboards, exhibit panels, and models in similar bins constructed to fit each item. Some offices keep projectors, cameras, and other equipment nearby; others store projection equipment in separate rooms. In either case the main objective is to have a specific place for each item of equipment; after loan or use, a machine is returned to its assigned storage spot. Such a system is helpful both to large, state offices or the smallest county office.

14.46 Movie films, tapes, and kineoscopes generally fit most conveniently in storage shelves manufactured for such materials. Similar shelves are not too difficult to construct. Films, generally packaged in metal cans, may be filed by subject-matter or alphabetically by title. Again, a checkout form of some nature provides a record of inspection, location and length of loan, etc.

14.47 It is possible to store and file slides in a variety of different ways. Probably one of the most convenient methods is to keep them in large cabinets holding vertical carriers in which slides may be fitted. Carriers hold from 50 to 100 slides, or more, and a cabinet may contain 25 to 100 carriers, depending upon size. Carriers may be pulled out from the cabinet for viewing and selecting slides without removal until time of use.

14.48 Smaller numbers of slides are more economically stored in homemade cases or manufactured boxes. Many county agents, with small collections, merely use empty cigar boxes in which to store slides, with the slides numbered for index reference. Photographic supply houses provide a variety of boxes made to hold from 25 to several hundred slides in separate grooves for easy access. Large collections can be stored in drawer cabinets made up of such boxes.

14.49 Filmstrips generally are packaged in metal cans. Storage and filing becomes a rather simple matter if one keeps all filmstrips in a central location, clean and free from dust and clutter.

14.4.10 Storage of flat photographs can be troublesome for anyone, especially if the supply includes several different sizes. Large photographs, useful for exhibit purposes — say larger than 8 x 10 — probably would best be stored on edge the same as charts and posters, particularly if they are mounted on display boards. Those photographs which are 8 x 10 in size fit easily into ordinary metal letter-file cabinets. You may wish to devise a similar system for 10 x 10 or 7 x 7 acetates for overhead projection. Smaller prints probably keep more conveniently in envelopes. Generally it works best to store photographs of like subjects in the same envelope — if they are kept at all. Some photographers dislike to keep small prints. They prefer to file and store only the negatives so that when a specific print is needed they can develop it for the immediate need.

14.4.11 Filing systems, whether for black and white negatives, colored slides, or acetates for overhead projection, should serve at least two purposes: (1) to hold the negatives or slides themselves together with relevant data regarding subject-matter and (2) to allow each picture to be found at a moment's notice. Of these, perhaps the second purpose is most important.

14.4.12 A contact print for identification of black and white pictures attached to a card and a system whereby cards contain negative numbers, date of exposure, and information regarding the subject will permit indefinite expansion of a system. Furthermore, a file that is organized in that way, enables location of a subject without excessive handling of negatives — which sometimes results in scratches or smears.

14.4.13 Negative files might take the form of albums, containing transparent or translucent envelopes. Commercial sources have these available for purchase. It is easy to make homemade albums from ordinary letter-size envelopes similar to the negative size. Punch holes in envelopes along one side so as to insert them into a loose-leaf binder. Some photographers prefer to file negatives by inserting them into envelopes, then filing the package in a metal card file. In

either case, each envelope should have a number matching a number on the negative inside, written in India ink on the margin of the film.

14.4.14 Small strips of film — say lengths of four or six exposures — are easier to handle than individual frames or negatives. Photographers place them in envelopes of suitable size and shape, then number the envelopes consecutively. The negative frames themselves contain the number and a letter suffix to the number. For instance, envelope 283 would contain negatives 283a, 283b, 283c, and so on.

14.4.15 Other photographers make print or proof sheets of entire rolls of film instead of individual contact prints for negative identification. They place strips on a sheet of 8 x 10 enlarging paper, expose and develop. Subject data goes on the back and the proof sheets are filed in an ordinary letter file.

14.4.16 It may be desirable to prepare separate files or albums to handle several different negative sizes — one for each size of negative. Or, providing a file or album will hold all sizes satisfactorily, one may wish to continue consecutive numbering, regardless of size.

14.4.17 Location of subjects, facilitated by arrangement of print cards or proofs, becomes difficult unless there is a simple system of categorizing subjects. Many state extension services have standard filing systems which might be duplicated as topic subjects for filing negatives. Another system, gaining in popularity over the country, is the Agdex system for classifying, indexing, and filing agricultural publications developed by the National Project in Agricultural Communications. Subjects are grouped under major headings and separated by topics or phases. It provides subject breakdowns and combinations of various subject areas, although the central core of the system is built around farm products.

14.4.18 Using the Agdex system to find a photograph on weed control in corn, one would first look under the basic heading of "field crops," then locate "corn," and the final category of "weed control." Cards or data sheets filed under that subject heading would each contain a contact print of the photograph available on weed control in corn and show the number of the negative on hand.

14.4.19 Photographs of people might be indexed alphabetically by the names of the sitters. Sections of a county or state or region also might be arranged alphabetically by place name.

14.4.20 Thus, indexing can be independent of the storage system. It may be desirable to index other visuals in the same file with photographic prints of negatives. Cards ideally might contain simple sketches or photographs of charts, posters, etc. Polaroid copies are easy to make, at little expense, and may be mounted on cards or put into a loose-leaf notebook index form.

14.4.21 Even small operations will find a filing system valuable, especially as new visuals are added to the office. But once started, it is vital that a filing system be kept up to date. There are no half measures. It is either complete and accurate or it is useless.

14.4.22 For further study about several methods for filing, in particular, the bibliography contains several books on the subject. Issues of *Modern Photography*, *Popular Photography*, and other photographic magazines also often carry articles on methods of filing photographs. Many of these methods are adaptable to the problems of filing and storing other visual materials.

14.5 Suggestions for Training

14.51 As previously mentioned, the responsibility for conducting a program in visual communication includes keeping others informed about the latest research, methods, materials, and equipment which would be useful in the conduct of the total program. Sometimes this leads to the erroneous belief that only the person responsible for conducting the visual operation or he who uses visuals more than anyone else can speak with any authority where visual communications are concerned. Hence, all problems arising in planning conferences, meetings, and workshops are referred to him. Such a practice leads to further separating the visual activities from their coordinative role in the implementation of the total extension program.

14.52 Of course the visual specialist — if there is one — will continue to serve as a consultant. But if more specialists, agents, and supervisors and administrators can become competent in the preparation and use of visual materials, they will be able to apply the principles of effective visual communication to their immediate problems. This is especially important if there is no specialist and only a person with other assignments who is responsible to other staff members for most visual consultant work. He simply cannot spend all his time on visuals, and the better informed about visual communication the rest of the staff becomes, the more likely such a system will work at all.

14.53 Many extension specialists and agents today generally agree that to use visuals is to improve their teaching. They say they have the problem of how to prepare materials; how to use materials effectively; how to use visuals without disrupting other activities. Some educators once were concerned with where to find visual material. Now they also face the problem of evaluating the tremendous amount of material available in order to decide which type best suits particular purposes. The needs of one staff also may be entirely different from those of another. At any rate, before anyone can develop a training program he should learn all he can of the strong and weak areas in which training is necessary — just as he determines needs for a visual program.

14.54 Six methods are common. First, the director or administrative officer of the organization may determine needs. Many training programs do owe their existence to a decision made by a single man. Second, a training staff may determine existence of a problem and even decide what the particular solution may be. Sometimes a clearer and more detailed account of training direction is produced through a third procedure when an advisory or management group studies a situation. Fourth, the job itself may determine specific needs—a widening concept of the job and the place the job occupies in relationship to the entire organization contributes to this. Fifth, individual specialists or agents may recognize difficulties and offer their suggestions for improvement through conferences, interviews, and informal discussions. Finally, a personnel inventory and survey can evaluate a program already in progress and help determine additional direction. It also can make use of case studies, problems, and tests to determine how individuals act. In a sense, this method of developing a training program is similar to the fifth—where individuals create and ask for the training.

14.55 Through the latter efforts, it is possible to establish some rather important principles of democratic action while also creating objectives for the training program. These are expressed by Koopman, Miel, and Misner in *Democracy in School Administration*[1] thusly:

1. To facilitate the continuous growth of individual and social personalities by providing all persons with opportunities to participate actively in all enterprises that concern them.
2. To recognize that leadership is a function of every individual, and to encourage the exercise of leadership by each person in accordance with his interests, needs, and abilities.
3. To provide means by which persons can plan together, share their experiences, and cooperatively evaluate their achievements.
4. To place the responsibility for making decisions that affect the total enterprise with the group rather than with one or a few individuals.
5. To achieve flexibility of organization to the end that necessary adjustments can readily be made.

14.56 Despite the number of texts devoted to administration of visual programs, few authors submit specific and practical suggestions for the development of *in-service training* programs. Periodical literature is more helpful. In it authors suggest that the logically organized in-service training program begins with national or regional conferences, followed by local conferences which arouse awareness of new tendencies. Others urge regular in-service classes or seminars in which use of visual materials and their production is emphasized. Still others, documenting local programs which were successful, place emphasis on demonstrations using selected materials before groups to encourage interest; enlisting the help of specialists, supervisors, or administrators in the planning of state or county visual programs; enlisting help of experienced workers in carrying on more formal training work with other workers.

14.57 In nearly all cases, writers recommended the use of homemade materials, local problems needing visualization, and the distribution of informative printed materials.

14.58 As one plans a training program, and as it progresses, he should ask instructors, trainees, and himself: "Can visual training be conducted with other training programs, agriculture or home economics? Are we placing so much emphasis on visual communication that other methods of communication are forgotten? Are we creating visuals as ends rather than means to the total extension program?"

14.59 Here are some suggested steps which might help in the development of a visual training program:

14.5.10 1. **Review literature.** Look over the latest books and brochures relating to visual instruction, planning, preparation and use of all

[1] G. Robert Koopman, Alice Miel, and Paul J. Misner, *Democracy in School Administration*, Appleton-Century Company, New York, 1943.

visual media. Note the various approaches. Abstract items which might be of value to the training program itself. Obtain a copy of *The Audio-Visual Equipment Directory* or some similar manual for discussions about equipment.

14.5.11 **2. Survey the individuals or groups who will be participants in the program.** Re-examine old requests for information; previous training of individuals; the skills and knowledge they already have; the equipment and facilities they have available for ready use. Compare individuals and their resources to see how to enlist their aid—as legitimizers, discussion leaders, etc.

14.5.12 **3. Catalog existing visual materials and equipment used in the organization.** Such a listing might be helpful as an indication of available materials and experience. It might also provide reminders to trainees of items they might wish to re-use.

14.5.13 **4. Establish an advisory group for training sessions.** Include people who have been exposed to other training programs, who are familiar with communication theory, who have successfully used visual materials, who are professionals in the visual field—education, industry, church groups, etc., all of whom have state and national organizations. Ask the group to pool individual ideas and experiences relating to the problem of in-service training; to training in visual communication. These people might be helpful with point #2.

14.5.14 **5. Prepare examples of multiple-use visuals.** Show how materials for one purpose have been adapted for another—magazine and bulletin illustrations to visuals for talks and exhibits, how slides may be converted to black-and-white enlargements, how television art becomes useful for demonstrations, how an actual object may substitute for experience about several different things.

14.5.15 Edgar Dale says that the teachers of the past were skilled in handling experience.[2] So must a trainer in visual communication provide co-workers with experiences in the use of visual materials. That may be no easy task, for an experience has scores and dozens of aspects and leads.

14.5.16 Thus, making multiple use of visuals means much more than merely using the same visual over and over again. Involved are all the ingenuity and creativity one can muster—complete freedom from inhibition. But of most importance is the simple, but difficult, wisdom of knowing *when to quit*. If we apply the principles of brainstorming and leave judgments by the wayside for a moment, even seemingly trivial acts may drive a point home.

14.5.17 **6. Prepare a list of local sources of supply.** Individuals in rural areas often may not realize that their nearby newspaper offices, hardware stores, grocery stores, stationery stores, dime stores, drug stores, and lumber yards handle many of the items helpful in making simple visuals. Included might be newsprint, poster board, brushes and felt pens, India ink, poster paints, peg boards, and so on. Local prices may be prohibitive, so investigate the situation, and, if possible, provide a list of sources where quantity orders may lower prices. Many times office closets, attics at home, even the local junkyard may contain materials that will stimulate the imagination. Similary a list may provide suppliers of materials which are not available locally.

14.6 Summary

14.61 Administration of a visual communication program involves adopting and promoting the philosophy that visual techniques are means to an end. They should be incorporated into an educational program to become an integrated part of communication efforts. Four basic principles apply:

1. Correlate visual communication efforts with other teaching materials.
2. Use visuals to support the subject-matter being taught.
3. Test visuals for response and effectiveness.
4. Relate visual messages to experience in order to reinforce other messages, and vice versa.

14.62 Little substantial research exists to offer guideposts to visual communication administration, but even the smallest operation can lend assistance to a broad knowledge of what visuals can and cannot do. Such an attitude is especially worthwhile, if we develop other attitudes showing that many effective visuals do not require a large budget and that the most important factors in visualization are common sense, alertness to new possibilities, and sincere interest in helping others learn.

14.63 Functions of a visual program vary, of course, but in general most operations

[2] "Role of Visual Materials in Education," *California Journal of Secondary Education*, Vol. 16, No. 1, January 1941.

should include handling of materials and services so that:

1. Use is always under best possible conditions.
2. Specialists may have materials and equipment when and where they need them.
3. Specialists may select and use materials which fit their teaching-learning situations.
4. Materials will be used as an integral part of the total extension program.
5. Specialists and agents make full use of the resources available locally.
6. Competency in use is assured for all who use them.

14.64 Problems of filing, storing, and adapting visuals should be solved by routine and simple methods. Locate storage spaces for charts, posters, exhibit panels, and equipment close together so that each item has an assigned spot. If possible, arrange an indexing system for photographic negatives to include other materials and equipment. The Agdex system of filing, developed by NPAC for agricultural publications adapts to filing visual materials just as do many of the systems already in use by the state extension services.

14.65 Training in visual communication is necessary if specialists, agents, and administrators are to become competent in the preparation and use of visual materials. A variety of methods for training are possible. Here are a few suggestions:

1. Review literature in order to be able to discuss questions which may arise; catalog existing materials and equipment now used.
2. Establish an advisory group for training sessions. Ask them to help survey the individuals or groups to be trained.
3. Prepare examples of multiple-use visuals; keep workshop problems localized; *use homemade materials when possible;* and distribute pertinent information about sources of supply.

14.66 Finally, in the midst of design and production, indexing and filing, it is necessary to remember that good administration of a visual program involves much more than the handling of materials, although this is important. The key to successful administration is a focus on people. Certainly if a communication point of view has value it should be put to use by communication specialists in their own administrative practices.

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